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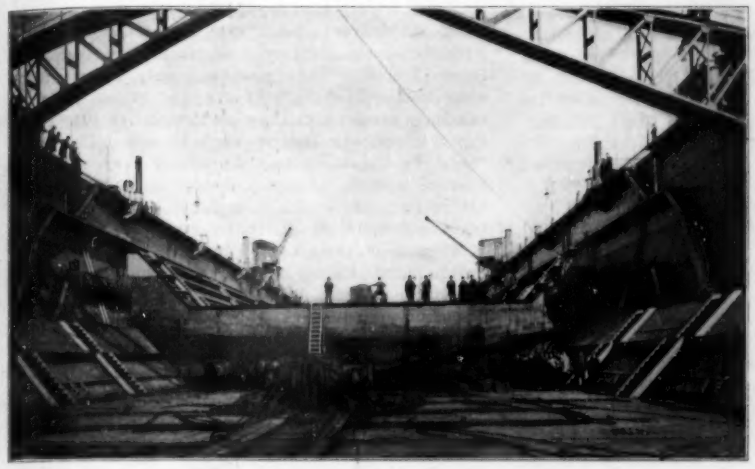
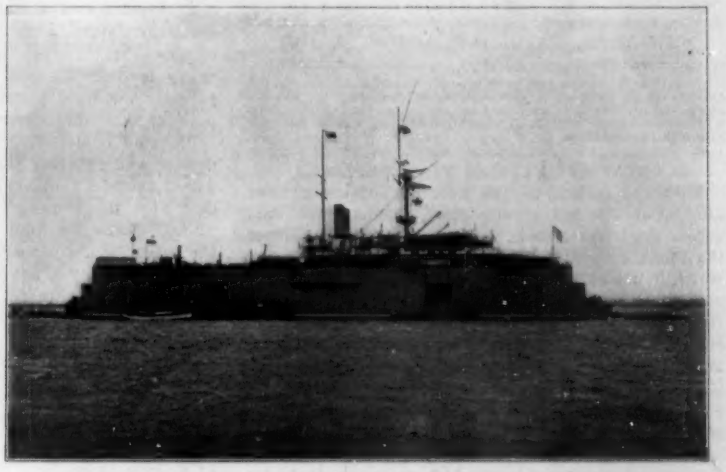
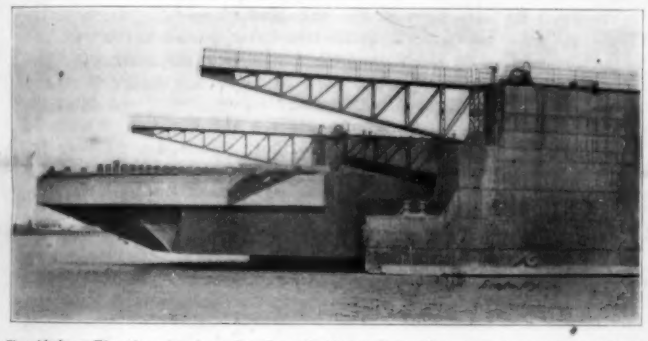


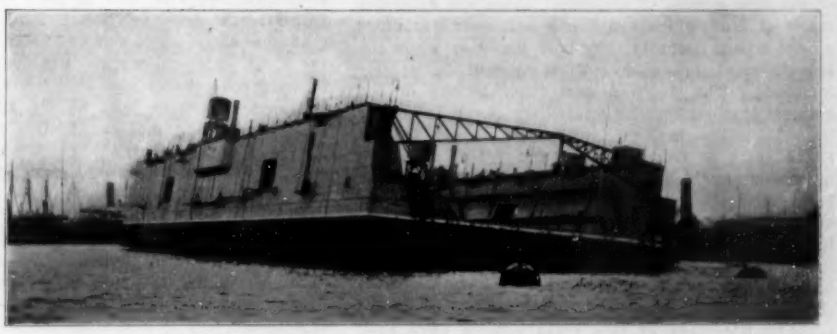
The Center Pontoon of the Bermuda Dock Raised for Painting.



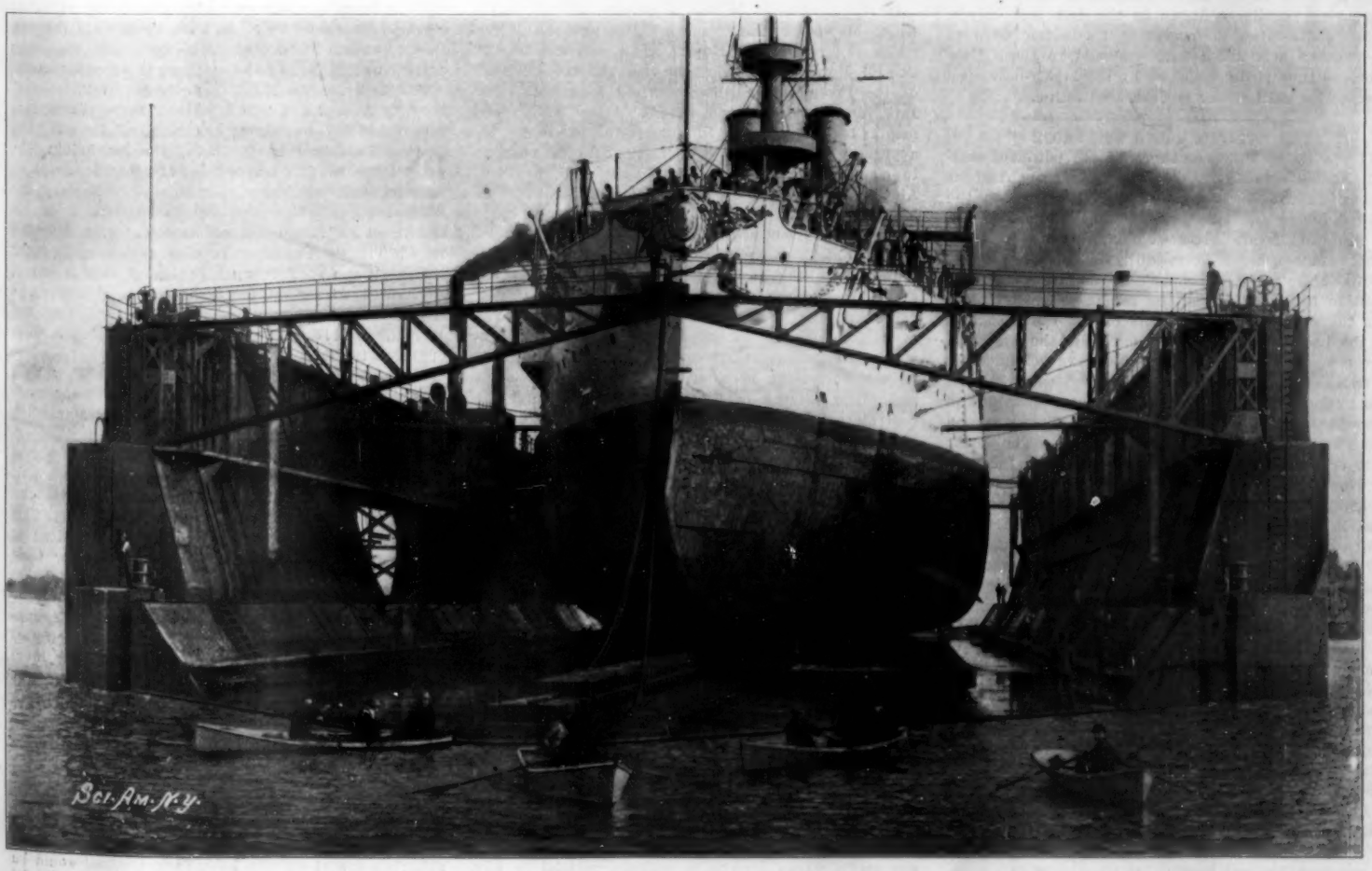
H. M. S. "Sans Pareil" (10,470 Tons) Lifted by the Bermuda Dock.



The Algiers Floating Dock, with Foot-Bridges Opened and End Pontoon Raised.



The Great Bermuda Dock Careened for Painting and Repair.



The "Illinois" in the New Floating Drydock at Algiers, La.

THE GREAT FLOATING DOCKS OF BERMUDA AND ALGIERS, LA.—[See page 88.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

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NEW YORK, SATURDAY, AUGUST 9, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A GREAT ENGINEERING FEAT COMPLETED.

With the laying, on the first day of the present month, of the last coping stone of the great dam across the River Nile at Assouan the ancient land of the Pharaohs sees the completion of a national work, which is not only the greatest of its kind in existence, but in its beneficent results will probably outrank any scheme carried out in Egypt, either in ancient or modern times. The completion of this dam and a similar structure at Assoiut will provide in the Nile valley a vast reservoir capable of supplying over a billion cubic yards of water every year. The surplus waters of the river will be stored during the flood season, and then drawn upon for the irrigation of wide tracts of land which for many centuries past have lain waste for want of water. As a result of the new system of irrigation, there are extensive tracts of land which henceforth will bear two crops a year where formerly they bore but one; while the area devoted to sugar cultivation will be greatly increased. The Assouan dam itself is one of the greatest engineering works in existence. It is no less than 1¼ miles in length and it is pierced by 180 sluice gates 25 feet in height and 7 feet in width, by means of which the regulation of the waters will be secured. The total cost of the two dams will be about $25,000,000, and the work has already proved itself to be an important economic feature in the life of the Egyptian people, for no less than 14,000 natives have found continuous employment during the progress of the work. The inauguration and rapid development of this great scheme have been due entirely to the enterprise of a western race, entirely alien to the Egyptian people; and there is something peculiarly fitting in the fact that Egypt, which contributed so largely in its earlier days to the world's arts and sciences, should in these later times be thus richly endowed by the highly-developed engineering skill of our modern civilization.

THE HALIFAX ROUTE TO EUROPE.

It was an inevitable outcome of the powerful shipping combine which has recently been brought about among the steamship companies plying between the United States and Europe that some attempt should be made to develop a rival combination with facilities that would enable it successfully to compete for the transatlantic trade. Inasmuch as the strength of the position held by the combine lies in the fact that it has the great railroad systems of the United States at the back of it, it was evident from the first that any competing interests must also have behind them a transcontinental road. Such a road exists in the great Canadian Pacific system, which provides a through transcontinental service from Vancouver on the Pacific to Halifax on the Atlantic. The latter port of call has a distinct advantage over the port of New York in the fact that it is over a day's steaming by the fastest liners nearer to Europe, and that it is readily accessible from deep water at all states of the tide.

In view of these facts it is not a matter of surprise that the Canadian government should have recently approached the British Parliament with the suggestion that a line of steamers should be established between Halifax and Liverpool, and that a subsidy of from three to four million dollars should be provided jointly by the Canadian and British governments. The proposal has provoked a natural enthusiasm in Canada, and it seems probable, at the present writing, that it will receive the favorable consideration of the English government. If Halifax be selected as the terminal port, passengers and mails will reach the United States about one day earlier than they do by the fastest ships of the German line at the present time. The speed of the proposed fleet of steamers has not been definitely determined upon, but it will not be less than twenty and may be as high as twenty-three knots an hour, the probabilities pointing to a sustained sea speed of twenty knots for the faster boats. To the average transatlantic passenger the proposed line should prove particularly attractive, since the competition thus established will serve to preserve passenger rates at their present figure and check that tendency on the part of the steamship combine to raise the rates, which, as we have lately pointed out in these columns, is giving uncomfortable proof of its activity.

THE MARCONI DISCLAIMER.

To the man who is at all familiar with British and American patent practice, the comments which have appeared in the newspapers on the announcement that Marconi has amended his British patent application in order that Marquis Solari might receive due credit for a certain contrivance, must appear decidedly unjust to the inventor to whom, more than to any other, the practical success of wireless telegraphy is due. Marconi has been placed in an apparently awkward position simply by reason of the peculiar rules that govern patents in Great Britain.

Probably one of Marconi's claims covered Solari's device; and in order that he might not invalidate a patent in which other devices were described, Marconi filed the necessary disclaimer. In the United States, where the filing of a disclaimer is optional, the patent would probably have passed to issue without any gratuitous newspaper criticism. Its validity would have been passed upon by the federal courts in a patent infringement suit; and even if it then transpired that a device covered in one of the claims had been invented by another the remaining claims would still be valid and their infringement would be enjoined by a Court of Equity.

From the meager accounts which have been received it does not very clearly appear what is the nature of Solari's invention. Even if Solari is the inventor of the mercury-coherer, used in combination with a telephone, which is said to have been employed in transatlantic signaling, it still remains to be proved that the entire system which Marconi uses is the result of another's work. Moreover, he announced that the coherer has been abandoned for transatlantic telegraphy. Marconi has so far shown himself an indefatigable and modest scientific investigator, who has spared neither time nor money in practically applying the discoveries of Heinrich Hertz. Although it is true that Branly invented the coherer, that Popoff first used the tall mast, and that many of the important elements of the usual wireless telegraphy apparatus had been invented before Marconi was heralded as the inventor of a new form of long-distance communication, nevertheless the fact remains that to him and to him alone the scientific success of space telegraphy is due; and to him perhaps will its eventual commercial success be credited.

It is not difficult to find a parallel to the battle which Marconi is now waging for recognition of his rights as an inventor. No one would now dispute the title of Morse to the telegraph, and yet the elements of the invention had been devised long before by Prof. Joseph Henry and others. Many an experimenter had labored long in endeavoring to produce an apparatus by means of which it would be possible to converse through long distances. Still, to Prof. Alexander Graham Bell justly belongs the credit of having furnished us with the telephone that bears his name. Given a number of old devices, an inventor ingenious and broad-minded enough to see their possibilities, and persistent enough to combine them into an apparatus capable of performing new functions, and a horde of claimants for the honor of having invented the apparatus evolved will forthwith arise. Such is evidently the usual experience of the successful inventor. Despite the persistent and bitter attacks of Sylvanus Thompson, and the cool disregard of German scientists for the work of Marconi, it seems reasonably certain that he will eventually receive his full meed of credit. A patent infringement suit is generally a thing to be avoided; but in Marconi's case it is almost to be welcomed, for only after a painstaking analysis by a United States Court will it be possible to appreciate fully how great has been the contribution of Marconi to wireless telegraphy.

FUTURE TRANSIT FACILITIES OF NEW YORK CITY.

The series of weekly discussions of municipal affairs by Mayor Low of this city have shown that he possesses a very thorough grasp of the municipal problems of America's greatest city. A striking instance of this is afforded by his last utterances on the subject of the future transit facilities of New York city, in which he carefully reviews the whole field and indicates in what direction the present various transit system must be enlarged, what connections must be made between them, and what new lines must be opened to accommodate a freight and passenger traffic whose growth is without parallel in any of the great cities of the world.

In reading over the nine pages of Mayor Low's typewritten statement we agree with him in his estimate of the transit situation, with the single exception of his indorsement of the possible abolition of the terminal loop below Forty-second Street station. We cannot but think that the New York Central Company's first design, embracing an electrically-operated terminal loop for suburban traffic, is the best possible solution of the problem at that point.

The paper discusses the whole subject broadly under three heads: Inter-borough communication between Manhattan Island and Long Island; communication with Manhattan Island from the north; and the improvement of the city's commercial facilities by the development of the water front of Manhattan Island.

Under the head of inter-borough communication, the Brooklyn Bridge naturally receives the first attention, and the keynote to the problem is sounded when the Mayor affirms that all bridges, and the Brooklyn Bridge in particular, should be treated as thoroughfares. "They must not only arrive; they must lead somewhere." If our readers will refer to the early accounts of the new East River Bridge, or the Williamsburg Bridge, as it is now called, published in the SCIENTIFIC AMERICAN, they will find that we strongly advocated the treatment of the new bridge as a thoroughfare, and not as a mere short length of railroad connecting two terminal points. Unfortunately, the present Brooklyn Bridge was built on the latter plan, its traffic to be carried by a system of shuttle trains; but the inexorable demands of traffic have practically, as Mayor Low shows in his address, converted the Brooklyn structure into a great railroad thoroughfare. Such it is to-day, such it will ever remain; and, therefore, in view of the fact that the present suspended roadway is loaded up to its safe limits, the proper thing to do is to rebuild the roadway, bringing its carrying capacity up to the strength of the cables and towers, which can sustain much greater dead and live loads than they do at present. The Brooklyn Bridge should be connected directly with the downtown financial districts to the south, with the Hudson River ferries to the west, and with the Williamsburg Bridge to the north. Of these connections a subway road between the Brooklyn and Williamsburg bridges is rightly considered to be the most urgently needed, and should be the first to be constructed. The northern connection is very important, not only as increasing the value of the Brooklyn Bridge, but as bringing the new Williamsburg Bridge, which will probably be opened by the autumn of 1903, in touch with the City Hall, thereby rendering that bridge, in its turn, a railroad thoroughfare. The new suspension bridge No. 3, which will be known as Manhattan Bridge, is to extend in Manhattan Island to the neighborhood of Canal Street and the Bowery, and we agree with the Mayor that the railroads of this bridge should be extended across the city so as to make connections with the west side elevated systems, as well as with those upon the east side. But we think that such connection should be carried underground and not by an elevated structure.

The new Blackwell's Island Bridge terminates at Seventh Avenue and will inevitably make connections with the elevated road, the natural agent for using the Blackwell's Island Bridge being the Manhattan Elevated Railroad, just as the natural agent for using as railroad thoroughfares, the Brooklyn Bridge, the Williamsburg Bridge and the Manhattan Bridge is the Brooklyn Rapid Transit system. The Brooklyn Rapid Transit Company is also the natural agent for using the second Brooklyn tunnel, which should be located so far as practicable to meet the views of that corporation; provided, of course, that the company will do its part in developing such thoroughfare traffic.

In the Mayor's opinion it lies with the New York Central & Hudson River Railroad to solve the problem of giving adequate connection between Manhattan Island and the suburban country to the north of it, and he states that he is authorized by the president of the New York Central Railroad to say that that road is ready to enter into a stipulation with the city (provided the city will approve the changes that they now wish to make at the Grand Central Station) to substitute electricity for steam, not only for their suburban, but also for their through traffic, and that they will sign a contract for the erection of power houses adequate for both of these purposes immediately after the approval by the city of their terminal plans. The company furthermore pledges itself to co-operate with the city in developing at some point or points in the Borough of the Bronx a union station or stations, at which passengers can change from their suburban and through trains to the Subway and to the various elevated roads running to the south. The Mayor thinks that such a union station and transfer system would obviate the necessity for the underground loop station at Forty-second Street: but it seems to us that while a large part of the suburban travel on the New York Central would be transferred at such a union station, there would still be a large proportion of the suburban travelers who would wish to continue directly to Forty-second Street

without change of cars. This number will steadily increase with the increasing growth of the northern districts, and, therefore, we think that the arguments in favor of a terminal loop would remain practically unaffected by the provision of a union station in the Bronx.

Finally, the Mayor suggests that in view of the splendid system of piers already constructed by the Dock Department, and the extensive additions which are about to be made, and, also, in view of the fact that adjoining the piers there will be a water front street, 250 feet in width, extending ultimately from Cortlandt Street to Thirty-eighth Street, an elevated railroad might easily be carried from the lower part of the island to a connection with the New York Central at Thirtieth Street, and that a connection would naturally, if this road were built, be made with the proposed Pennsylvania Railroad tunnel beneath Manhattan Island. With such a road constructed, every transatlantic steamship pier on the western side of Manhattan Island would be directly connected with the New York Central and the Pennsylvania Railroad systems. We agree with the Mayor that such a road, if built by the city, would ultimately prove to be a very fruitful source of revenue.

The improvements above outlined are conceived in the broad spirit and with the far-sighted outlook which has characterized all of the proceedings of that most admirable body, the Rapid Transit Commission; and we would urge the point that, so far as the city's debt limit will allow, the necessary legislation for these improvements should be immediately secured and the work put in hand. If there is one lesson more than another that the history of New York City's Rapid Transit teaches it is that it is best to be beforehand rather than behindhand in providing transit facilities. The city's traffic grows at such a phenomenal rate that the possibility of providing more facilities than are necessary is exceedingly remote.

SIMPLON TUNNEL.

BY OUR FRENCH CORRESPONDENT.

The Bulletin of the Société des Ingéneurs Civils contains an account of the recent work on the Simplon Tunnel, as brought out in the last quarterly report for the state of the work on the 31st of December last. It is on the southern side that the work has been interrupted by the great outflow of water from the subterranean reservoirs. On the north side but little water was encountered, but on the south side no less than twelve springs were found. The enormous pressure which some of these springs showed on their first appearance is no doubt due to the presence of a subterranean basin existing in the fissures of the gneiss and limestone, but especially the latter. It is easy to imagine the formidable disturbance which the piercing of the tunnel brings about in opening a water passage at a level of 2,000 feet below the surface of a basin which up to the present has been in a state of complete stability, traversed only by the currents of an internal circulation. A basin of this kind produces an output which increases with the number of openings, and this output will remain practically constant from the moment when no new openings are made. This is the case at present, and since the beginning of November the quantity of water has been nearly constant at 250 to 270 gallons per second. But the diminution of certain springs which has occurred recently shows what is likely to arrive for the others, owing to the lowering of the basin level. As soon as the subterranean reservoir becomes emptied there will no doubt be a rapid decrease in the volume of water, and the affluent water will then come out directly by the openings. The approach of this period is indicated by the increased cooling of the water. The affluents come neither from the Avino or the Cairasca lakes, as has been proved by the coloration test which was made on the 3d of December, but the reservoir is supplied from the water collected by the Leggiolo and the valley of the Alpe di Valle. This surface receives enough rain water and snow to feed a spring of 1,500 gallons per minute and it is noteworthy that a group of springs of this capacity existed at the Alpe Membro, on the right bank of the Cairasca, at 4,000 feet altitude. This spring, which still flowed abundantly up to the 29th of October last, had completely dried up before the 20th of November, thus proving the existence of a subterranean reservoir whose overflow was at an altitude of 4,000 feet at least. The influence thus exerted upon the spring by the piercing of the tunnel shows the enormous extent of the subterranean water system, as the tunnel is at a horizontal distance of 1¼ miles from the spring and over 2,000 feet below its level. The formation of the underground canals is no doubt due to the disintegration produced by the water. The water-circulation, which is supposed to pass from the surface of the water down to perhaps a thousand feet below the level of the tunnel, is caused by the subterranean heat, which makes the hot water mount to the surface, like the action of a thermo-siphon. This explains the difference of temperature in the different streams coming but a short distance from each other. There must be currents of hot water mounting and currents of cold water descending. The differences in the density of the water is explained by its passage through layers which are alternately calcareous or gypsum-like. As to the general cooling of the water which manifests itself as the flow continues, this seems to be due to the rapid lowering of the basin, which is a relatively stable body, and is being replaced by supplies of colder water coming directly from the surface. When the reservoir becomes completely emptied, these springs will no doubt give the outflow its minimum temperature.

It is expected that the exhaustion of the reservoir will coincide with a rapid decrease in the volume of outflow. If the Membro spring, above mentioned, is the only system which served as an outlet for the reservoir, this volume will then be between 25 and 40 gallons per second. If other springs, such as those of Prese de Gebbo, are suppressed in turn, which is at least probable, we must expect a permanent flow of 85 gallons per second. In any case, it seems certain that the volume of water now flowing in the two galleries of the tunnel is exceptional and will last only until the basin is emptied. Prof. Schardt, the geologist of the Simplon Tunnel, treats the same question in a conference held before the Société Vaudoise de Sciences Naturelles at Lausanne, and gives some interesting figures. He remarks that this deplorable outflow of water coincided with the approach of the limestone, and that, contrary to what usually happens, the temperature of these springs has fallen with the advancement of the tunnel, and that the new springs which are found increase in coldness. Moreover, the same springs continue to become colder, and fall as low as 11.5 deg. C., when the normal temperature of the water should be from 36 to 37 degrees. Besides, the water showed, simultaneously with these modifications of temperature, a general increase in density which has reached from 30 to 75 degrees *hydrotimetric* (one such degree corresponds to the presence of a centigramme of limestone or 0.014 gramme of sulphate of lime per liter). The greatest outflow of water occurred in the limestone between the 260th and 265th mile points of the tunnel. From the 1st of October to date (19th of February) there has flowed out of the mountain more than 350 million cubic feet of water. The average outflow he gives as 210 gallons per second, which gives in round numbers 108,000 cubic feet per hour, or nearly 2,600,000 per 24 hours. This volume of water would suffice largely to supply a city of 150,000 to 200,000 inhabitants. Taking account of the difference of level of the basin and the tunnel, this average output if 210 gallons per second falling from that height would represent a work of 7,700 horse power.

As to the work of piercing the tunnel, the advance of the northern side during the month of February was 524 feet, which brings the length of the gallery to 20,700 feet. Here the tunnel passed through the gneiss and crystalline schist in which the mean rate of cutting was 18 feet per day. The length of the southeast gallery is 13,660 feet, which has not varied, so that the total length now pierced reaches 34,360 feet, which is 55 per cent of the total length of the tunnel, or 60,834 feet. To show how the work is progressing, the tunnel company made a communication to the Secolo, of Milan, contradicting the unfavorable reports received by the Italian press as to the state of the work. The following figures show the annual advancement:

		Annual feet.	Total feet.
1st year,	Nov. 13, 1898 to Nov. 13, 1899	7,400	7,400
2nd "	" " 1899 " " " 1900	11,410	18,810
3rd "	" " 1900 " " " 1901	12,640	31,150
4th "	" " 1901 " " " 1902	14,180	45,330
5th "	" " 1902 " " " 1903	15,200	60,530
6th " last months of	1903 to May 14, 1904	—	—

The last six months will be devoted to finishing the excavations, building revetment walls, etc. The tunnel will have a total length of 60,530 feet. According to the programme, approved by the concessionary company of the Jura-Simplon, the tunnel should now be at the 35,770 point, while 34,380 feet have been pierced; the difference, or 1,350 feet, is but slight and is less than a month's work. Since there is a margin of some months in the last half year it cannot be said that the programme is not being carried out. Two years remain to finish the work and cut 26,500 feet, which comes to 36.4 feet per day for the two galleries. This is quite possible, given the nature of the rock according to the official geological profile, which cannot be inexact except in details. On the Brigue side, where the work goes on regularly according to the plans, the advance is always 18 feet per day. The same progress will be made on the Italian side as soon as the present difficulties are overcome.

According to the data furnished by the last monthly report which has been received since writing the above, the progress made during the month of March has been 543 feet on the north side of the tunnel and 40 feet on the south, or in all 583 feet, which brings the total cutting to 34,940 feet. On the southern side the work had already passed through the loose mica schists which formed a bad portion extending over 60 feet. In this part were placed 43 metallic frames since the 18th of January, including 17 in the month of March. On the 17th of March was blown the first mine pierced in the front of the southern attack, after a period of four months of hand cutting. It was expected to recommence the mechanical drilling about the middle of April. According to this report the streams of water, although they are quite abundant (representing a mean of 200 gallons per second) do not at present hinder the work.

SCIENCE NOTES.

A communication by M. Berthelot in Comptes Rendus shows that the Chaldeans and Babylonians were possessed of considerable metallurgical skill. A Babylonian statuette was found to consist of a copper alloy containing 79.5 per cent of copper, 1.25 per cent of tin, and 0.8 per cent of iron. A statuette from Chaldea, estimated to be 2200 years old, was composed of nearly pure copper containing only a slight proportion of iron, whereas another Chaldean statuette, some 400 years older, consisted mainly of an alloy of four parts of copper with one part of lead and a trace of sulphur.

Some interesting experiments for the purpose of obtaining data regarding the earth's rotation have been carried out by the two eminent French scientists, MM. Berbet and Camille Flammarion, with the Foucault pendulum on exhibition in the Panthéon, Paris. This pendulum is the largest ever made. It consists of a ball of lead weighing 56 pounds, attached to the end of a specially-made fine piano-string approximately 210 feet in length—the longest piano-wire ever drawn. The oscillation lasts eight seconds in either direction—sixteen seconds in all—and the pendulum apparently displaces itself in the opposite direction to the movement of the earth's rotation. The pendulum affords one of the most comprehensive lessons in astronomy that has ever been given to the public.

In speaking on the interference of sound recently, before the Royal Institution of London, Lord Rayleigh described some of his experiments with fog-horns made for Trinity House. Fog-horns with elliptic cones instead of circular cones were tried, the major axis being about four times longer than the minor. The experiments showed that the sound was best spread in a horizontal direction when the long axis was exactly vertical. It appears to be doubtful whether the phenomenon of the silent area is really due to interference between waves of sound reaching the spot directly and those reflected from the sea. If the effect were due mainly to interference in this way it ought to be possible to recover the sound by the listener's changing his altitude above the sea surface, but Lord Rayleigh has on several occasions tried this on board the "Irene" and has not recovered the sound.

A new detonator has been devised by a Berlin inventor for firing explosives, consisting of pulverized aluminium mixed with detonating and oxygen-yielding substances. The aluminium is used in the shape of powder as an ingredient in detonating compositions, and especially of those mixtures for filling detonating or percussion caps for starting the detonation of explosives. The detonation composition varies according to the explosives employed, but in each instance it is essential to utilize the thermic properties of aluminium, which produces a very high temperature when burnt with oxygen-yielding substances, in consequence of which the mechanical energy developed is much higher than that obtainable with the compositions containing no aluminium. Owing to this peculiar property, a small quantity of aluminium composition is sufficient for detonating explosives, on which the compositions hitherto used free from aluminium have little or no effect.

Two French explorers, M. Pierre de Jecquer and M. Watlin, have been carrying out some interesting excavations for archæological purposes in Persia, and have made several valuable discoveries. At Susa they unearthed a large black marble column, covered from head to foot with cuneiform inscriptions, which should throw much light on the history of that ancient capital. According to the terms the explorers have made with the Persian government, they are not compelled to examine their treasures at Susa, but are permitted to transport them to France. Originally the concession permitted them only to share equally with the Persian government, but they were molested and attacked by the natives at Susa, and by way of compensation they obtained the right to take everything they require from Susa. In other parts of Persia the Shah claims his share. Generally the explorers work four or five months at Susa, and then before the winter in Susiana becomes intolerable, they migrate to the northern parts of the country, where there are ample fields for exploration. In this way they are gradually unfolding the history of past ages, and at the same time adding considerably to the present incomplete knowledge of Persian geography.

A UNIQUE RAILWAY.

BY C. E. PRICE.

Probably the shortest paying street railway in the world, and certainly one where more rides can be obtained for a dollar than anywhere else in America, is the "Angel's Flight" in Los Angeles, California.

General View of the Railway and Observatory Tower.

Formerly the pretty residence portion of the city, "Olive Heights," could only be reached either by a long detour or climbing a great number of very steep steps. One of Los Angeles' citizens conceived the idea that a railway up the steep incline could be made to pay, and within a few weeks he had his road in operation.

The road is 350 feet in length between terminal points, and rises one hundred feet in this distance; it is built on the three-rail, automatic, turnout system. The two cars, "Olivet" and "Sinai," are attached to the ends of a double cable, which is wound over a drum operated by a ten horse power electric motor at top of the hill. As one car goes up, the other descends, the two cars counterbalancing each other, and thus effecting a great saving in power.

Entering the lower station, the first thing we notice is the "bill of fare." "One ride 5c., 3 rides 10c., 10 rides 25c., 100 rides $1.00." The cars will hold ten people seated, which is the limit; a number of signs announce that no standing is allowed, as a sudden jar might throw the passenger out and down the steep incline. Another sign instructs the passenger to press the button when he is ready to start, and on his doing so the car starts. During the ascent a beautiful view is obtained of Los Angeles. Arriving at the top, one steps from the car into the ticket office, where he pays his fare, and passes into a small building, open at the sides and filled with comfortable seats, from which the view may be enjoyed, and where a sign informs the passenger that he has reached "Angel's Rest." Here is a pretty little terraced park with flowers and a fountain. Then by climbing the stairs of the large iron observation tower to the "Angel's View," 156 feet above the street below, another excellent view is had of Los Angeles, the surrounding towns, and the Pacific ocean.

It was estimated that the patronage of the people living on the Heights would pay the expenses of the road with one-cent fares, and that the tourist and curiosity seeker, in their anxiety to ride on so unique a road and obtain the view from the tall tower (which, by the way, costs 5 cents extra), would furnish the profit. As the cars can make a trip every minute, and the one man in the power house can run the cars, collect the fares and perform the duties of all the several officials necessary on an ordinary railway, the expenses are light, and the enterprise bids fair to be as much of a success from a financial standpoint as it is from a mechanical one.

A Car Descending the Steep Grade.

A UNIQUE RAILWAY.

The Price of Progress in Agriculture.

BY B. F. W. THORPE.

Special development of plant and animal life to their highest degree of excellence and productiveness brings an increased liability to disease and derangement. The very effort of producing an abnormal yield of milk in the dairy animal, of flesh and bulk in the beef and draft breeds, or those intensive qualities of nerve, bone and muscle combining to make possible the two-minute racer, is at the expense of a part of the inherent vitality of the animal in question. The same principle holds true in the plant world. The most highly improved and prolific varieties of fruits, grains and other vegetable products have reached their positions of excellence, as a rule, with a certain loss in vigor in some direction. In short, there is apt to be a weakening in resistance power against exposure and disease in both plants and animals when any particular function is worked beyond its natural capacity. Thus have utility breeding and hot-house methods of improvement created a greater necessity for protective remedies against pests and diseases, as well as a greater need of vigilance in their application in the realms of both animate and inanimate nature. In addition to the above-mentioned causes the constantly expanding territory devoted to agriculture and the rapid increase and extension of commerce serves to promote and distribute the husbandman's hindrances in a constantly increasing ratio. It is not the writer's intention to here enter into detailed consideration of these forces of opposition which the modern farmer has to intelligently meet and conquer, or at least effectually hold in check to insure compensation for his toil. Rather the idea is to emphasize the need of keeping well abreast of the higher levels of thought and improvement which do not remain stationary for a single year, or season even. The National and State stations of experiment and investigation from Maine to California, north, south and central, have at all times scores of scientific and statistical grists feeding into their experimental hoppers from which all grades of intellectual food-stuffs are issuing. These bulletin brain-rations composed of figures, facts and fiction later pass through the sifters, blowers, cleaners, graders and retorts, comprising the agricultural press, farm organizations and individual farm experiments, where by the aid of "quiz" column, question box, discussion, essay and editorial comment the practical is eliminated from the theoretical. It has been mainly by such helps that the reading and thinking farmers have been enabled to make such strides in both method and quality of production as to cause the admiration and astonishment of the civilized world. Those farmers who have heretofore expressed contempt for "book farming ideas" have been doing some quiet thinking while critically observing the effects produced by adaptive fertilizing, utility breeding, intensive tillage, disease and pest controlling remedies and other of the lengthening list of science-founded helps. The fact is dawning on many such former skeptics that a few dollars judiciously expended for farm publications and books treating on special and general lines of their work, with a reasonable amount of time devoted to study and discussion, may be profitable, not only in direct financial returns, but in the increased respect felt by themselves and others for their occupation. The progress attained in agriculture, practically in the past half century, though so marked and far-reaching in effect, is but the beginning of the triumphs which are to follow in this most important and fundamental of industries. Nearly all the inventions and discoveries which have revolutionized the industrial world are found to bring additional profit and power to the farmer as he becomes qualified to take advantage of nature's unlocked secrets. The farmer must realize the full importance of the fact that his vocation is pre-eminently the one where practical adaptation must be combined with exact compliance to fixed natural laws, or, in other words, agricultural science. These necessary laws are not very numerous or difficult to get a working knowledge of, but must be comprehended sufficiently to make their importance understood. The progress already attained and now steadily going forward must ere long make the farmer's lot in reality what is has always been in possibility, among the most attractive and noble of pursuits.

Oil Fuel for Torpedo Boats.

One of the objections to the use of oil as a fuel for vessels has been the heat of combustion, which, it is claimed, is too intense for the endurance of the men in the boiler-room. In order to determine whether this objection is of sufficient weight, the United States Naval Department is about to make an experiment with the torpedo boat "Rodgers." The crew is to be engaged for five days in a test, which will be conducted by the members of the Board on Oil Fuel and which will show conclusively whether petroleum can be successfully used on this type of craft.

A New Time-Fuse.

It is reported that a new time-fuse for armor-piercing shells has been successfully tested by the Ordnance Department, under the direction of its Chief, Brig.-Gen. William Crozier. The chief merit of the fuse is to be found in the fact that it does not detonate the shell until the plate has been penetrated. It is said that a shell fitted with this fuse and fired from a 12-inch gun penetrated 14 inches of Krupp armor before detonation. The importance of these results will be appreciated when it is considered that the thickest Krupp armor so far made is but twelve inches.

The tests were conducted with the army 12-inch rifle, which is heavier than the navy weapon of the same caliber. No doubt good results can be obtained with the navy gun.

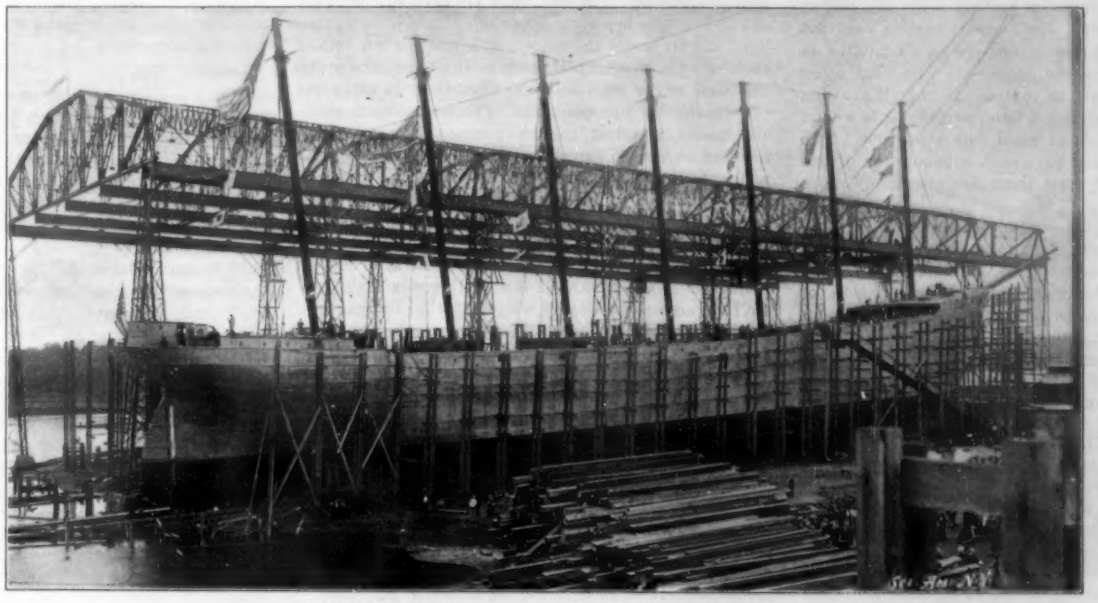
View Showing the Two Cars Passing at the Automatic Turnout.

Further News of the "Belleisle" Tests.

In spite of the great secrecy preserved by the British officials, additional information has leaked out of the results obtained during the recent tests made with the old battleship "Belleisle." If all accounts are to be believed, the result was a decided triumph for the conning tower, which, though covered with old compound armor, withstood the attacks of 9.2-inch guns. A rat imprisoned in the tower for the purpose of determining the effect of lyddite fumes and the concussion of shot and shell was found to be uninjured. How destructive was the lyddite was shown by the total destruction of two torpedo nets.

LAUNCH OF THE FIRST SEVEN-MASTED STEEL SCHOONER.

The recent launching at the yards of the Fore River Ship and Engine Building Company of the seven-masted steel schooner "T. A. Lawson" was an event of more than common significance in the shipping world. The fore-and-aft trading schooner is a distinctly American craft. The history of its development from the original two-sticker up to the multi-masted vessels is full of interest. It is only of late years that the many-masted type has received any extensive development; but so successful have the four, five and six-masted schooners been, that it was only a question of time when a seven-masted craft should be constructed, for in this matter of shipbuilding, as in so many other forms of construction characteristic of our modern industrial life, it holds true that the bigger the unit, the less the cost of operation, and the larger the profits.



LAUNCH OF THE FIRST SEVEN-MASTED STEEL SCHOONER.

The largest schooner previous to the launch of the "Lawson" was a six-masted vessel which measured 330 feet in length, 48 feet in beam and 22 feet depth of hold, with a maximum carrying capacity of 5500 tons of cargo. That vessel, like all of her predecessors, was built of wood. The ship recently launched, however, is a great advance on her predecessors in every respect. In the first place she is built throughout of steel, with a cellular double bottom and three complete steel-plated decks. The lower masts throughout the vessel are also built of steel. The total length of the ship over all is 395 feet, beam 50 feet, and molded depth 34 feet 5 inches. She has a dead weight cargo capacity of 7500 tons and her displacement at her maximum draft is 10,000 tons. The sail plan is drawn on a generous scale. The main masts are all 135 feet in length from the mast step to the top of the upper band, and they are all of a uniform diameter throughout of 32 inches. The topmasts are of one length, being 58 feet in length over all and tapering from 18 inches to 10 inches in diameter. The total sail area of the lower sails and top sails is 40,617 square feet. The sails will be handled largely by steam power, the plant including a 9 x 10 double-cylinder ship engine, and five 6 x 8 hoisting engines, with two vertical boilers, one in the forward and one in the after house. As a result of the installation of steam power for hoisting the anchors and handling the same, the number of hands necessary to work this huge vessel will be reduced to nineteen men. The total cost is $250,000. The craft was designed by B. B. Crowninshield, of Boston.

Test of the 10-Inch Coast Defence Gun.

It will be remembered that in last week's SCIENTIFIC AMERICAN was chronicled the test made at Fort Monroe with an 8-inch gun. On July 28 at Sandy Hook a 10-inch gun on a barbette carriage was fired for rapidity and endurance observations. The first ten shots were fired in exactly sixteen minutes, the shortest intervals between shots being one minute twenty-five and two-fifth seconds.

After this test a series of thirty rounds was fired. The official time between the firing of the first and tenth shot of this series of thirty was thirteen minutes and twenty-two seconds. The next ten shots were fired by another crew in nearly nineteen minutes time. The final ten rounds were fired by a base-ball and foot-ball detachment, whose training was such that the ten shots were fired in ten minutes and fifty-nine and two-fifth seconds. The firing of the entire thirty rounds took only forty-six minutes.

HINTS FOR AMERICANS—TRANSPORTATION IN SOUTH AMERICA.

BY C. E. HOET.

After an extended tour through South America, the writer is convinced that one important reason why American goods are so seldom seen is because we will not adapt ourselves to the transportation facilities on that vast and populous continent. In all but one or two of the many large ports of South America steamers anchor off shore and all merchandise is transferred to the small docks by means of lighters. This necessitates an extra handling of goods, and therefore stauncher packing, a very essential point. In many places goods are carried by natives or Indians, either on their backs or suspended from a pole which rests across the shoulders of two men. In this manner quite a considerable weight is often carried. I have seen cases weighing 400 pounds carried through the streets by two men; on one occasion I saw four men carry an upright piano. This, however, only holds good in the smaller cities; in the larger ones transportation is chiefly by wagons. It is into the interior, however, that most of the imports find their way, and as the continent is vast in size, the area of South America being equal to two and one-third times that of the United States, long distances must be covered, the method of transportation being as a rule to pack goods on the backs of burros. When we find horses they are o very small st ture, excepting in the southern or colder sections, and these small animals have a limited carrying capacity. Roads being scarce, goods must be packed on the backs of these diminutive animals, and packages should not weigh more than 150 pounds, and even that is strenuously objected to in many localities.

LLAMAS USED IN TRANSPORTING GOODS FROM AND INTO BOLIVIA.

BURROS USED IN TRANSPORTING GOODS THROUGH PERU AND BOLIVIA.

In some sections of the continent, especially along the west coast, I found the modes of transportation strangely interesting and picturesque. These conditions vary in the different localities. Arriving at Mollendo, a port of southern Peru, through which pass practically all imports and exports of Bolivia, I found it was a most difficult problem to bring goods ashore on account of the rough waters, merchandise and passengers alike being hoisted onto the small dock by means of a steam crane. From here starts the great Arequipa and Puno Railroad, which has its terminus 317 miles away at Puno, on Lake Titicaca, whence merchandise is transshipped via steamer to Chililaya, in Bolivia, a country which has no seaport, having lost the province of Antofagasta some years ago. From here all goods are transported on the backs of burros, the typical donkey, for Bolivia is the home of this valuable pack animal. The burro will carry some 300 pounds on his back and travel day after day with but very little food or water. In the higher altitudes, and Bolivia is one of the highest inhabited countries on the globe, La Paz, the capital being some 12,000 feet above sea level, we find that graceful and invaluable pack animal, the llama, which will travel farther and with even less food than the burro, but will not carry more than 150 pounds. The llama resembles a camel, kneeling in camel fashion to receive its load, and it will not arise if more than 150 pounds are placed on his back; moreover, the weight must be evenly distributed over his back and sides.

Much complaint is made by the South Americans about the marking of cases. They should be marked in Spanish, the official language of all South American countries except Brazil, where Portuguese is

spoken. The contents of the case, giving the exact weight, net, tare, and gross, should be plainly marked. To these matters the English and German merchant, who control the South American trade, pay strict attention, and this is one of the reasons why they receive the preference.

Americans will not lay any strong hold upon the great South American trade so long as the existing conditions in those countries are not made the subject of more careful study. Their credit system does not appeal to us, for it is a long time credit, six months on the average, but European houses vie with each other in the persistent effort to control the rapidly-growing markets of South America. Commercially it is a land of present importance and great future promise. Two cities on the east coast have each a population of one million; on the west coast there are also many cities densely populated.

The objections to the credit system could be overcome, but we must first learn to pack our merchandise in small, light and strong cases, suitable to the conditions exacted by the unavoidable circumstances of primitive transportation. Although it is true that many railroads exist, and that several of consequence are in course of construction, this vast continent contains millions of inhabitants who depend absolutely on the burro and llama for transportation.

THE GREAT FLOATING DOCKS OF BERMUDA AND ALGIERS, LA.

BY ROBERT C. FYFE.

Particular interest attaches just now to the question of dry docks, on account of the fact that the "Illinois," the latest of our battleships to be put in commission, is now in drydock abroad, for the repair of serious damage done to her hull by running aground while she was on the European station. It was this fine vessel that was chosen to represent the United States at the great naval review at Spithead, which was organized as part of the ceremonies attendant on the coronation of King Edward VII. After the postponement of the review, the "Illinois" had the misfortune to run aground on rocky bottom and tear open the forward part of her hull, thereby flooding one of the forward compartments and rendering extensive repairs in drydock necessary.

This sudden crippling of our finest battleship will naturally direct renewed attention to the two great floating drydocks which have recently been constructed and placed in service. One of these, constructed for Bermuda, was built by Messrs C. S. Swan & Huster, of Wallsend-on-Tyne; another, which is now at Algiers, La., was built by the Maryland Steel Company at Sparrow Point. Both of these were designed by Messrs. Clark & Standfield, London. Although the Bermuda dock is actually the largest, the Algiers dock is the more powerful. It may be interesting here to institute a comparison between these two and also the old floating dock, which was towed out to Bermuda in 1869, and which is to-day one of the largest floating docks in the world.

	New Bermuda Dock.	Algiers Dock.	Old Bermuda Dock.
Length of dock	545 feet	525	381
Length of end pontoon	120 feet		
Length of middle pontoons	300 feet		
Width between fenders	100 feet		84
Width of pontoons	96 feet		
Height of vertical walls	58 feet 3 in.		
Length of vertical walls	435 feet		
Thickness of wall	13 feet 1 in.		
Total width of structure	126 feet	100 feet	123 feet 9 in.
Lifting power up to deck level	15,500 tons	18,000 tons	8,000 tons
Extreme lifting power	17,500 tons	20,000 tons	10,000 tons
Weight of hull	6,300 tons	5,850	

When it became evident that a new dock must be made at Bermuda the Admiralty were anxious to get an ordinary graving dock made. Borings were made, but everywhere the geological formation proved unsuitable for the purpose. The old dock was rendered obsolete, not from decay, but because ships have increased so greatly in weight and in dimensions.

The simplest definition of a graving dock (by which we mean the sunken or excavated type) is a hole dug out in the foreshore below high tide level, with its seaend closed by a caisson or gate. The vessel is floated into the excavation, the ends closed by a gate, and the water then pumped out. Similarly a floating dock may be defined as a box built of wood or steel, which is allowed to fill with water so that it sinks. The vessel to be docked is drawn over it, the water in it pumped out, and by its buoyancy it lifts the vessel out of the water.

The modern floating dock is "self-docking." This means that it is capable of taking itself to pieces and lifting any one part out of the water when necessary for cleaning or repair. This is a very necessary condition in a hot climate, where floating structures are exceedingly liable to have their bottoms incrusted with marine organisms and slime.

The new Bermuda floating dock consists mainly of five chief parts, comprising three pontoons and two side walls. The three pontoons form the bottom of the dock and are placed between the side walls; they form the main lifting portion of the dock. The two side walls are chiefly designed to give stability and to afford control over the dock in sinking it to take the ship on board; they also do some of the lifting work. The center pontoon is 300 feet long and is rectangular in shape; the two end pontoons are each 120 feet long and have each 70 feet of the length rectangular in plan, the outer portions being beveled off in a way that will facilitate towing. The side walls are each 435 feet long and 53 feet 3 inches high. For the purpose of admitting light and air under the bottom of a vessel when docked there are two large openings in each of the side walls. The ends of the side walls are beveled off to carry out the lines of the end pontoons. The vertical side walls are firmly attached to the pontoon bottom, being fastened by double fish-plates and tapered pins, to take which there are steel lugs built into the structure, both of the walls and pontoons.

The new Bermuda dock is both longer and heavier than any floating dock that has ever before been built. It is 545 feet long, and its clear width between rubbing-fenders is 100 feet. As the side walls are a little over 13 feet across, the total width of the structure is somewhat above 126 feet. The lifting power up to the floating deck level is 15,500 tons; but by using the shallow pound this can be increased to 17,500 tons. The weight of the hull is 6,500 tons. The sides or walls are high enough to enable a vessel of 32 feet draught to be berthed on the keel block, the latter being 3 feet 6 inches high.

The new dock is capable both of docking itself and also of docking a battleship or cruiser. Each of the side walls can be lifted separately out of the water, and each of the pontoons can be lifted separately, so that any portion of the dock can be examined, cleaned, repaired or painted as occasion requires.

For the docking of a vessel the dock is sunk to a certain depth by taking in water ballast; the ship is then floated over, and, the water being pumped out, the vessel is lifted out of the water, thus allowing of repairs being made in her under portions. The three pontoons are divided into 40 pumping divisions, and of these 32 are water-tight. The side walls have also 8 water-tight compartments in each. All these divisions are provided with a separate pipe each, with a valve. All the pipes on each side lead directly into the main drain of their respective side. There are four 18-inch centrifugal pumps in each wall, and any one pump can empty all the compartments in its half of the dock. If the whole of the pumping machinery on one side were to break down, the other half could still empty the dock, though, of course, at a slow pace. The pumps are driven each by a separate compound condensing engine directly attached.

Although the new Bermuda dock exceeds the Algiers structure in length by 20 feet and in weight by 650 tons, the latter has greater lifting capacity. It recently lifted the United States battleship "Illinois," a vessel of 11,565 tons displacement. Up to positive level it will raise 18,000 tons, and if the "pound" be utilized the capacity could be increased to 20,000 tons.

The battleship "Sans Pareil" was selected to test the new dock. This battleship is a sister ship to the ill-fated "Victoria," rammed by the "Camperdown" in the Mediterrean in June, 1893. She is 340 feet long and 70 feet wide. Her armor is 18 inches, tapering to 16, and she carries ten 16¼ 110-ton guns in one heavily armored turret well forward. These guns are the largest carried in any fleet. The "Sans Pareil" entered the dock about 12 o'clock, and she was then drawing about 27 feet 4 inches.

At a little after 2 o'clock the pumps were started and they were kept at work until the battleship was lifted out of the water and the pontoon deck was high and dry. The lifting of the "Sans Pareil" took about an hour, and the port guardship at Sheerness was then towed back to her moorings. During the docking care had to be taken that both sides of the dock rose equally, and on this occasion all fortunately went well.

The new Algiers floating dock recently successfully lifted the United States battleship "Illinois," of 11,565 tons displacement, and a word may be said here as to the different methods employed for docking vessels in the British and American navies. The American plan is to attach to the bottom of the ship exterior longitudinals or stout side keels. Rows of blocks are placed for these in the dock, as well as the usual blocks for the central keel. The vessel then sits upright on level blocks and requires no shoring except for centering. The British method is to poise the ship on her keel and prop it up by a large number of raking struts and bilge shores. The former plan certainly saves time, and it is stated that the docking keels have no appreciable effect on the speed of the ship with which they are built. Those who are against the American plan argue that as a ship passes very little of her time in dry dock it is better that such a weight should be at rest in one drydock than that hundreds of ships should have to transport the burden all over the world.

In certain quarters there has been, and is perhaps still, a prejudice against floating docks, but the successful docking of the "Sans Pareil" and the "Illinois" in the two new great docks should do much to convince critics that the floating dock is capable of performing any work that may be required of it. It would perhaps surprise many people to hear what an amount of sea these docks can stand. Floating docks have been moored in the open Pacific for a number of years, and we learn that they have succeeded in dealing with vessels in quite a respectable swell. The two floating docks of this type have often been at work in bad weather when the graving docks in the vicinity have been unworkable.

London, Eng.

British Trade.

Notwithstanding the heavy competition which Great Britain is experiencing in the shipbuilding industry, according to the recent issued official statement of navigation and shipbuilding, the United Kingdom is easily holding its own in this ramification of trade. During 1901 775,681 tons of vessels were built in British yards, being an increase of 40,000 tons over the tonnage for the previous year. The total tonnage of British merchant shipping in 1901 was 9,524,496 tons, or 130,000 tons in excess of what it was in 1900. Vessels totaling over 200,000 tons were built for foreign buyers. A very comprehensive estimation of the extent of British shipping may be gathered from the fact that during 1901 more than one-half of the total imports were brought on British vessels, and two-thirds of the exports were carried on vessels flying the English flag.

Wreck of the World's Largest Locomotive.

The huge locomotive recently built for the Santa Fé Railway to haul freight over the Step Raton Mountain Road, was wrecked on July 29. In company with two other engines the giant locomotive was taking a very long train over the mountains. Three times the train broke in two. When the last break came the long train started to back down the steep grade and the giant locomotive was unable to hold it. The brakemen, after having tightened every available brake, were finally compelled to jump for their lives. After a mad downward plunge of three miles the train jumped the rails on a bridge, 50 feet high, near Seymour. The engine and all the cars plunged down the cañon. The engine is the largest freight engine in the world.

The Krupps and the St. Louis Exposition.

News comes from Berlin that the Krupps have refused to exhibit at the St. Louis Exposition because the United States did not purchase the great gun which they sent to Chicago in 1893. Whether any reliance is to be placed upon this piece of information cannot at present be determined. At all events it cannot be denied that since it is against the policy of this country to confer decorations, many exhibitors will have nothing to show for their trouble. It is suggested that Emperor William recognize the best German exhibitors by bestowing orders upon them. No doubt this would overcome a difficulty which may hamper the officials of the exposition.

The Current Supplement.

The current SUPPLEMENT is opened by a well-illustrated article on the French sardine industry. The passage of the Panama Canal Bill has been of interest not only to Americans, but also to Europeans. For that reason a discussion of the canal from the English point of view is timely. An article written from such a point of view will be found in the SUPPLEMENT. Dr. Marcus Benjamin has prepared a digest of the public lectures read at the American Association for the Advancement of Science. "Counterfeiting and Counterfeiting-Protecting" is the title of a paper which tells much that is probably new to the general public. Mr. Howard Crosby Butler writes on the "Sculpture of Northern Central Syria." His paper is illustrated by photographs. Two natural history articles, the one on "The Dragon-Fly's Flight and the Means of Its Accomplishment," and the other on "The Nesting Season of Birds of Prey," are both entertaining and valuable. Just now the claims of rival inventors in the field of wireless telegraphy are attracting much attention in the daily press. Consequently a very exhaustive and very fully illustrated paper on the "Paternity of Wireless Telegraphy" is of rare interest. The miscellaneous notes and consular information will be found in their usual places.

A portable garbage crematory, the invention of Morgan J. Cragin, of Chicago, was recently tested at a New York apartment house. One of the features of the apparatus is the employment of a grate constructed of hollow piping, by means of which it is possible to combine the disposal of the garbage with the heating of water. In this manner it is possible to use garbage as a fuel.

Sir John Aird announces that the last coping stone of the Nile Dam at Assouan was laid on July 30.

Electrical Notes.

It is announced that a company has been formed with a nominal capital of £175,000 for the purpose of operating the Armstrong-Orling system of wireless telegraphy. Factories are to be erected in Buckinghamshire and in France. The step is the outcome of experiments made in Hughenden in the autumn of 1901, when electrical impulses were sent through the ground without wires and without poles. It will be remembered that the SCIENTIFIC AMERICAN described very fully how, during the experiments, a torpedo was moved at will to the right or left by pressing a releasing lever of a small transmitter.

Osmium has the highest melting point of any metal, viz., about 2600 deg. C., and it can, therefore, be used at a higher temperature than carbon in an incandescent lamp, making the efficiency correspondingly higher. The lamp is the invention of Dr. Auer von Welsbach, and the Auer Company, who are making it, will shortly be letting out lamps on hire. Owing to the rarity of osmium, it is found worth while to employ the metal remaining in the filaments after they have burned out. The chief difficulty appears to be the low resistivity of osmium. Owing to this, up to the present lamps of 25, 35 and 50 volts only have been produced, and the smallest candlepower of a 35-volt lamp has so far been 40. The lecturer described experiments made with a 20-volt lamp at different pressures. At 20.5 volts the lamp gave 22 candle power, and required 1.48 watts per candle. At 25 volts the efficiency rose to 0.99 watts per candle and the candle power to 46. At 30 volts the figures were 0.654 watts per candle and 99 candle power; at 35 volts 0.487 watts per candle and 171 candle power; at 40 volts 0.38 watts per candle and 275 candle power; and at 50 volts 0.32 watts per candle and 460 candle power. At this pressure the lamp burned out. A life test was made on another lamp at its normal pressure. This lamp required 1.5 watts per candle at the commencement, dropped gradually to 1.36 and 1.32 watts per candle, and finished at 1.4 watts per candle after 1100 hours. During this time the candle power, which started at 14.8, rose gradually to 16.8 after 250 hours, and then dropped to 15 candle power after 1000 hours' use.

One of the most important substitutions of electric for steam traction in Italy has been carried out by the Mediterranean Railroad Company upon a system of lines starting from Milan. The main branch goes from Milan to Gallarate, 25 miles, and thence start three separate branches which supply the Lago Maggiore region and have their termini at Arona, Laveno and Porte Ceresio, with lengths of 16, 19 and 20 miles. The Milan-Gallarate line passes through a densely populated region and the traffic is constant throughout the year, while the three branches supply the tourist traffic, which is considerable in the summer and autumn. In order to meet the competition of the local tramway lines the company was obliged to change its system. Since the new system was inaugurated last October the passenger traffic has increased 50 per cent. The direct-current system is used for the motors, and the trains have a speed of 50 miles an hour. The energy is supplied by a hydraulic and a steam plant on the Tessin, which generate 3-phase current at 12,000 volts, and this is fed to the line by sub-stations at 650 volts. The third-rail contact system is used. The hydraulic plant, at Tornavento, is under construction. Meanwhile the road is fed from the steam plant. A fall of 25 feet is obtained here by a branch canal, which delivers 140 cubic yards per second, representing 11,000 horse power. The dam upon the Tessin is constructed upon the Poirée movable system, with 179 sections. The canal, which is over 40 feet wide and 12 feet deep, is navigable. The station has eight large turbines, which drive the alternators, and two smaller ones for the exciters. The main turbines generate 1200 horse power and the dynamos 742 kilowatts. The steam plant will be used as a reserve when the hydraulic station is finished; it has eight boilers and three horizontal Corliss engines of 1400 horse power, which drive triphase alternators. The latter give 13,000 volts at 25 reversals. From the station the current is transmitted by two main lines at high tension, and these supply the five sub-stations for the road, where the current is transformed to 420 volts direct current by sets of rotary converters. The third rail, carrying the current, is supported along the road every 12 feet upon earthenware insulators protected by a cast-iron cap which receives the rail flange. The rolling stock consists of 20 motor cars and 20 trailers, of 55 feet length, having two first-class compartments containing 24 passengers, and two third-class containing 39. The cars have a vestibule at each end, in which is also the motorman's cab. The motor cars will hold in all 75 passengers, and the trailers 90; the former have four Thomson-Houston motors per car, which take current from the side rail by four sliding contacts. The express trains make a speed of 55 miles an hour, and the ordinary trains 20. The road started last November with 38 trains per day, but since January 42 trains have been running.

Engineering Notes.

Considerable prominence has lately been given in the press of the world to the fact that not a passenger on the English railroads was killed during the year 1901. It may prove of interest to know that on the Mexican National Narrow Gage Road, from Corpus Christi through Laredo to the city of Mexico, with its branches amounting to more than 1,200 miles of operated road, for more than twenty years no passenger has been killed. This, in the face of the fact that this road climbs more mountains, turns more curves than any road in the United States.

According to Engineering News, a special trolley car for conveying fire engines is in use at Springfield, Mass. The engine is carried on a platform only nine and one-half inches above the top of the rail, mounted on a truck at each end. The front truck is detached and the front end of the platform lowered to the ground when the engine is to be loaded on the car. Platforms over each truck afford space for firemen and equipment. The length of the car over all is 30 feet 10½ inches, and its net weight is 14,000 pounds. The Springfield Fire Department has loaded an engine on one of these cars in two and one-quarter minutes from the time the car was in position to its being ready to start, and has unloaded an engine and attached the horses to it in one and one-quarter minutes.

Most of the roads reaching the recently developed oil fields in the Southwest are actively engaged in making the necessary changes, or have preliminary arrangements under way, whereby oil will be used as locomotive fuel on the equipment operating locally in this territory. There is economy in the use of oil in comparison with coal in this district, where the cost of coal is above and the quality below the average, but just how much is as yet undetermined from reliable information. Conservative estimates, says the Railway Age, place the saving at from 15 to 20 per cent. This reduction is not based on the relative cost of actually producing one horse power by use of coal or oil as fuel, but involves the comparative cost of the handling of both, and it is from this source that the greater proportion of the economy must be looked for, as in some instances the actual cost of the amount of oil used for fuel has exceeded the cost of coal in performing similar service. This may possibly have been due to improper combustion, but it illustrates the fact that care must be taken in the selection of the proper appliances for using oil to effect an economical consumption.

The production of pig iron in the first half of 1902 was 8,808,574 gross tons, against 7,674,613 tons in the same period of 1901 and 8,203,741 tons in the second half of 1901. The production of pig iron in the United States for the first half of 1902 was more than a million tons greater than the production of either Great Britain or Germany during the whole year of 1901, the total production of these countries being 7,761,830 and 7,736,663 gross tons during that period. The production of Bessemer pig iron during the first half of 1902 was 5,105,932 gross tons, against 4,582,187 tons during the same period of 1901. The production of basic pig iron during the first half of 1902 was 1,053,274 gross tons, against 645,105 tons in the same period of 1901. Charcoal pig iron production for the first six months of 1902 was 186-098 gross tons, against 194,231 tons in the same period of 1901. The stocks of pig iron unsold in the hands of manufacturers on June 30, 1902, amounted to 29,861 tons, against 70,647 tons on December 31, 1901, and 372,560 tons on June 30, 1901. The total number of furnaces in blast June 30, 1902, was 286, against 259 at the same period of 1901.

Mr. Charles Rous-Marten recently read a paper before the English Society of Engineers, in which he stated that a large proportion of English locomotives are 20 years old, and that some are even 30 and 40 years old. British locomotives only 20 years old, he remarked, were regarded as comparatively modern. While the longevity of these engines certainly spoke well for the material of which they were built, it could not be denied that they were out of date and unfit for modern railway purposes. The loads of the older engines were limited to five-sixths of that hauled by modern machines; in other words, six engines with six separate trains were required to perform the work of five improved machines on roads already congested. Furthermore, the cost of labor and working expenses were increased. In comparing English with American practice, Mr. Rous-Marten stated that our engines were not expected or even desired to last more than 10 or 15 years at the most, and that they were then displaced by new engines fitted with modern improvements and possessing a large margin of power. Although he deemed the extreme longevity of English locomotives distinctly undesirable, he also questioned the wisdom of using inferior material and workmanship which, it must be confessed, is often characteristic of the American locomotive.

Correspondence.

A Substitute for Coal-Burning Apparatus Wanted.

To the Editor of SCIENTIFIC AMERICAN:

Since the coal strike has promised to interfere with the domestic supply of coal for the winter, I have scanned your columns each week for advertisements of hydrocarbon burners, suitable for ranges and the ordinary house-heating steam boiler, but in vain. Do you not think the present a fine opportunity for manufacturers of the above apparatus, in all the branches thereof, to push the sale of such articles? And, doubtless, many who could successfully use oil for fuel would not return to coal. In my house, a frame dwelling in a nearby Jersey town, I have a range connected to a hot-water tank, water-back or boiler, etc., and a cast iron "pot" form of steam boiler supplying eleven radiators. As prudence in trying a new burning agent would dictate, beginning early to investigate the subject, I appeal to you to help me to get in touch with manufacturers of oil burners for ranges and small steam heating plants.

F. T. CAMP,
Asst. to Supts. Construction L. S. S.
New York City, July 31, 1902.

Gravitation as a Cause of Volcanic Action.

To the Editor of SCIENTIFIC AMERICAN:

In relation to the action of the sun and moon on intensifying volcanic disturbances, it seems quite possible that a volcano on the point of eruption would be more liable to burst forth with the combined action or gravitational pull of the sun and moon acting in conjunction on a part of the earth that stood square before the sun. The action, if any, must be due to the gravitational pull or tidal effect on the liquid interior of the earth.

The electrical disturbances being of a secondary nature, no doubt caused by the heat from the volcano, the planetary influence or their positions are insignificant as compared with the attraction of the sun and moon. With the possible exception of the planet Venus its gravitational pull, although slight, if added to that of the sun and moon while in conjunction might be the means of opening one of nature's safety valves. As for comparison pass a large magnet over the safety valve of a steam boiler that is on the point of blowing off and note the effect.

On referring to the almanac we find the sun and moon May 7 in conjunction almost directly overhead of the island of Martinique, and allowing a few hours tidal lag of the liquid interior we find the greatest effect at about the time Mont Pelée blew up. Similar conditions are again due on the 3d of August. And if the pressure has not been greatly reduced by the last eruption we may look for increased activity at about that date.

A. H. BARBER.
Watertown, N. Y.

The Telephone as a Surgical Instrument.

According to a London medical journal, several London hospital surgeons are now using the telephone, whenever they have occasion to probe for bullets, or other metallic objects embedded in the body of a person. The receiver of the telephone is placed on the head of the operator, and the patient is placed in the usual manner, in contact with a plate; the general medium employed being a wet sponge or some paper saturated with a saline solution, which is spread over the plate. The latter is connected with a telephone by wire, and the probe after it has been introduced into the body vibrates as soon as the foreign metallic substance comes in contact with it. The probe is also connected with the telephone by a wire, and thus no such blunder is possible as sometimes happens when an ordinary battery is used. When a telephone is used in this way, the plate acts as one pole and the probe as the other. Needles, bullets, grains of shot, and pieces of steel and copper have been easily located by use of this simple method. The only instances when the telephone does not work satisfactorily are when the objects to be located are of the same metal as the probe. French and German surgeons have been following these experiments in London, with the intention of introducing the same method into the hospitals of Berlin and Paris.

Abandonment of the Oiled Roadbed.

After having oiled their roadbed for three years for the purpose of preventing dust, the Boston & Albany road has decided to abandon the practice. The oil-soaked sand and fine cinders have been removed and in their place broken stone is now used. The reason for the change is to be found in the bitter complaints which have been received by the railway company. A particle of the oil-laden sand sticks to whatever it strikes. Women have protested against the spattering of oily dirt. That oil is certainly a most effective dust-preventer was graphically shown some time ago in the columns of the SCIENTIFIC AMERICAN by the comparative illustrations of oiled and unoiled roadbeds.

THE NEW MARCONI WIRELESS TELEGRAPH STATION AT CAPE BRETON.

It will be remembered that immediately after the first successful transmission of signals across the ocean by the Marconi wireless system, the work of constructing three stations, two in America and one in England, for the regular transmission of commercial messages, was put in hand. The European station is situated at Poldhu, Cornwall. On this side of the ocean the station used in the original experimental work was erected on a lofty point at the entrance to St. Johns Harbor, Newfoundland, but on account of the opposition of the Anglo-American Telegraph Company, which holds a monopoly of transatlantic telegraphic rights in Newfoundland, Marconi abandoned that site and selected two new locations, one on the easterly coast of Cape Breton, Nova Scotia, and the other at Cape Cod, Massachusetts. The station at Glace Bay, Cape Breton, of which we present a group of illustrations, is located on a promontory of land, whose surface lies about 70 feet above mean high water. The plant consists of four huge towers for carrying the vertical wires, and a group of one-story buildings arranged at the base of the towers, in which are contained the powerful electrical plant which has been specially constructed for the station.

The present article is devoted to a description of the four great towers, which take the place of the familiar single mast that is used where transmission is to be conducted over moderate distances. It will be understood that for the regular transmission of commercial messages over distances measured by the thousand miles a vastly greater capacity is necessary, both in the generation and the reception of the Hertzian waves, than suffices for the ordinary messages over from 50 to 100 miles, of which we have heard so much of late. Hence the truly gigantic proportions of the aerial system which is herewith illustrated. The necessary height for the vertical wires has been attained by the erection of four braced wooden towers, each 215 feet high, at the four corners of a square which measures about 200 feet on a side. Each tower consists of four legs, built up of 3 x 12-inch plank, the legs being braced together on each face of the tower by 3 x 9-inch braces. The planking of which the legs are built is laid up so as to break joints as much as possible and secure the approximate strength of a solid 12x12-inch stick. The legs are spaced 30 feet from center to center at the base and 9 feet from center to center at the top platforms. The foundation of each tower consists of a mass of concrete formed in a hollow square, in which are embedded the 12 x 12-inch sills and the first panels of the lateral bracing. In section this concrete mass is 6 feet in width by 8 feet in depth, the external dimensions of the foundation being 36x36 feet and the internal dimensions 24 x 24 feet.

The experience had with previous attempts to carry a set of lofty aerial wires, more particularly that at Cape Cod, which was wrecked in a heavy gale, proves that the weakest feature in those structures was the system of guy-ropes with which they were held in position. The fall of the Cape Cod structure was due to the parting of the extreme weather guy-ropes, the method of tying the towers adopted having been such that practically the whole strain fell upon a few stays. In the present case the towers are tied in such a way that the stress on each tower will be transmitted directly to its own set of cables, every one of which will be doing useful work. The wires are carried from three points on the towers (the lower and upper third and the summit), all wires having an inclination of 45 degrees. The ropes are all made of the best plow steel, the majority of them being 2½ inches, and a few 3 inches. The method of carrying the aerial wires upon the structure is as follows: Four 3-inch cables are strung from platform to platform at the top of the towers, as shown in the accompanying diagram, and from these cables depend 150 aerial wires. These are drawn together and united in the center of the tower into a single cable, which descends vertically to enter the transmitting and receiving house below. The average length of the aerial wires before they meet in the common central cable is about 140 feet.

During a recent visit of a member of the staff of the Scientific American to the Cape Breton station Mr. Vyvyan, the engineer in charge of the station, stated that Marconi has ceased to use the coherer and has substituted a receiver of much greater reliability and capacity. It was always difficult to secure an absolutely reliable coherer of the old type, since out of a hundred of these little instruments thirty or forty might be good, thirty would be poor and thirty would

ONE OF THE 215-FOOT TOWERS, SHOWING DETAILS OF CONSTRUCTION.

be absolutely unusable. The new method of receiving adopted by Marconi has a capacity should it be required of several hundred words a minute. This improvement, taken with the great power and capacity of the plant, render it practically certain that, when in the

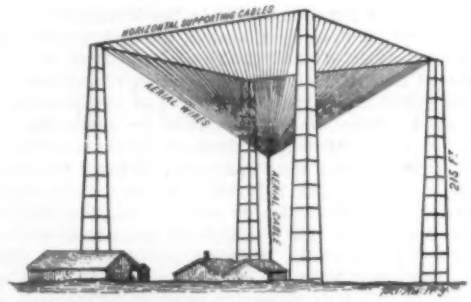
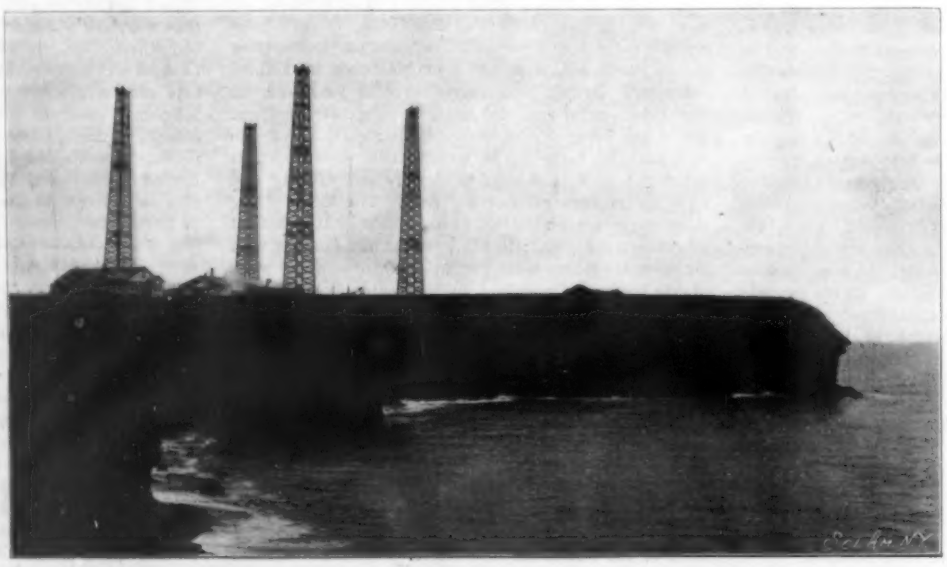


DIAGRAM SHOWING METHOD OF STRINGING THE 150 AERIAL WIRES AT THE MARCONI CAPE BRETON STATION.

course of a few weeks the station is opened, it will prove to be capable of dealing with any class of commercial messages that may be required. Mr. Vyvyan further stated that it would be possible to send and receive messages to and from San Francisco, the earth resistance being very much less than is popularly supposed. The power of the new installation was far greater than would be demanded for transmission to Europe, and it is probable that before the close of the present year messages will be sent direct from Cape Breton or Cape Cod to Cape Town, South Africa.



THE NEW MARCONI WIRELESS TELEGRAPH STATION AT GLACE BAY, CAPE BRETON.

The Edison Portland Cement Plant.

Thomas A. Edison's improved process of manufacturing cement was put to practical use last week, says the Orange Journal, when active operations were begun in the Edison Portland Cement Company's new plant at New Village, near Stewartsville, Pa. Mr. Edison and directors and stockholders of the new company were present when the ponderous machinery was started for the first time. More than 300 men will be employed at the start, and as this force will be gradually increased the industry will mean much to Stewartsville and vicinity.

After conceiving the idea of improving upon the old process and discovering an inexhaustible deposit of cement rock at Stewartsville, Mr. Edison formed a company. This was more than two years ago, and since that time about sixty-six men have been at work constructing the twenty-seven buildings and installing the machinery. The plant, which is one of the largest of its kind in the United States, covers a space half a mile long, and one-quarter of a mile wide. It has thus far cost over a million and a half dollars. The machinery is built for a capacity of 10,000 barrels per day; but the buildings were made to accommodate half that amount at the start, and if the business proves successful the plant will be increased to its fullest capacity in a few years. There are twenty-seven buildings and the roasting-house is separate from the others. All the others are connected by a deep tunnel half a mile long, fifteen feet wide and twenty-five feet deep. The stock-house contains two 600-foot corridors, one above the other, and connected by big flues. There the cement rock will be roasted and prepared for the refining process. From that building starts the tunnel mentioned. The raw material will be conveyed by means of an electric railroad through the tunnel from the stockhouse to the crusher, and thence to the dryer. The tunnel is made of solid rock walls and paved with concrete. The dryer is a simple stone shaft twenty feet square and forty feet high. Inside are a series of drying pans.

The crusher is located in a building four stories high, the two sides being of solid masonry, ten feet thick at the bottom and five at the top. The floors are of steel construction. The machinery is capable of crushing 25,000 barrels of cement rock every twenty-four hours. The rollers have a pressure of 100,000 pounds to the square inch. In order to get results Mr. Edison made use of a discovery by means of which, with the aid of pulleys worked in connection with air compressors, he could get the great pressure directly upon the steel rollers with less than 1000 pounds pressure on the bearings. All the cement rock will be transported through the tunnel as it is moved from one building to another. The raw material is received at the roasting-house and there the cement rock will be roasted and prepared for the secret refining process invented by Edison, and which is expected to revolutionize the cement industry. Before the product is again handled by hand it will automatically travel several miles through the many buildings. One hundred and twenty-five motors are used in the plant. When the last stage of the process is reached the cement will flow into barrels, in a building through which several railroad tracks pass, thus permitting the barrels to be loaded as fast as filled. All the buildings are of steel, covered with corrugated iron and painted black.

The agricultural districts of Gujarat, British India, are experiencing a plague of rats. The rodents have consumed the crops of sowed grains, and have caused much suffering among the inhabitants. In some places the people have dug out the accumulated stores of grain from the rat-holes, and found as much as ten pounds collected in one burrow. So acute has the crisis become that the government offers large rewards for the extermination of the pest. But the object of the government has hitherto been largely defeated owing to the superstitions of the natives, who persist in their original theory that the unusual numbers of rats represented souls

of the departed in the late famine, and refused to make any attempt to exterminate them. This curious apprehension, however, has now to a great extent been overcome and now many thousands of rats have been killed in various sub-divisions, but it is an open question whether anything but the next heavy downpour of rain will bring about any appreciable decrease in numbers. The method adopted by the natives in destroying rats for the reward is somewhat surprising, although simple and apparently efficacious. At night a party goes out with a lantern and armed with bows and arrows. The rats are said to be attracted by the light, and the sportsmen, armed with bows, shoot them as they come within range. It is no difficult matter to discover the animals, since the ground is honeycombed with their burrows, and they teem in their thousands.

Dispensing With Platinum.

The piece of platinum foil which forms part of the outfit of every beginner in chemistry, and of most working chemists, has become so expensive of late that acceptable substitutes are worth considering. Very pure silver is actually superior to platinum for most of the uses to which such pieces of foil are usually put. It must be very pure; the thick sheets used as anodes by electroplaters are pure enough, and of a convenient thickness. Or, any chemist can easily purify his silver and then get a jeweler to melt and roll it.

When used for evaporating solutions to dryness the silver is liable to be attacked by oxidizing acids, but this action can be prevented by the addition of ammonia, which is generally unobjectionable. For fusions, however, the silver is altogether preferable. Being unaffected by alkalies, it can be used with caustic soda, instead of the carbonate, and thus a lower temperature suffices; manganese and chromium fusions are readily performed. The silver is so cheap (a piece an inch square and a sixteenth thick should cost about twenty cents) that thicker, and hence stronger and more durable pieces can be used; with such heavy pieces a strip an eighth of an inch wide may be cut so as to project as a handle, and the assay is thus freed from liability of contamination by material from the tweezers which hold the foil in the flame—generally a great nuisance with platinum.

The platinum wires, also, which are used to hold salts in a flame for spectroscope work, may be replaced by iron—with advantage, for the iron may readily be thrown away if they get mixed or incrusted.—W. P. White, University of Wisconsin.

The Largest Known Tree.

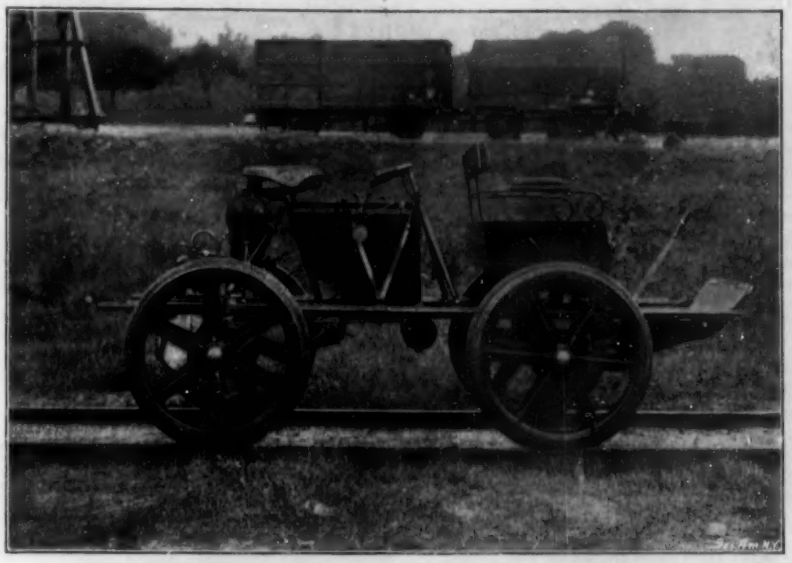
In last week's SCIENTIFIC AMERICAN mention was made, in the article on lumbering in California, of what was considered the largest tree in the world. News now comes from Fresno of the discovery of a tree which probably exceeds in size any that has so far been known. This newly-found tree, measured six feet from the ground, is 154 feet and 8 inches in circumference, from which it follows that it is about 50 feet in diameter. Fortunately the tree stands on the Government Reserve, and will therefore be spared the attack of the insatiable ax.

The Ardennes Automobile Contest.

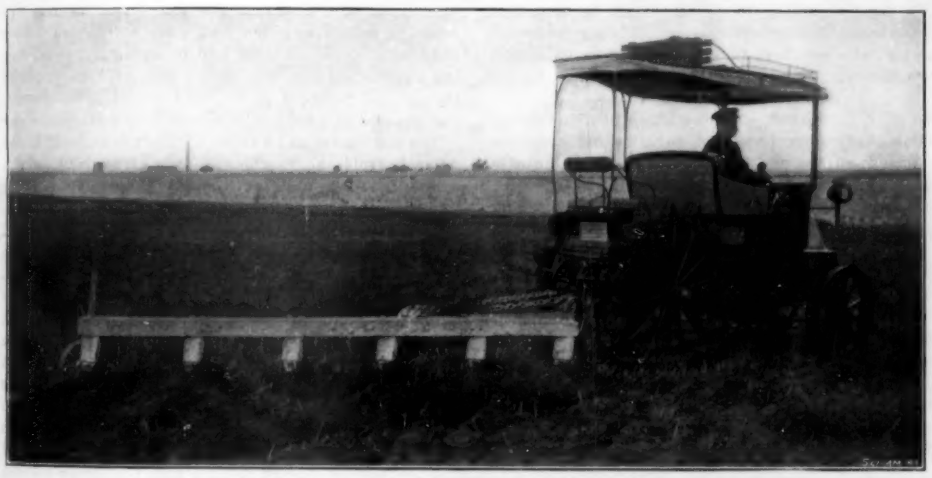
The great Ardennes automobile race was won by an Englishman, Mr. Jarrot, who covered the distance of 318 miles in five hours and fifty-three minutes, or at the rate of 57 miles an hour. The course, more than fifty miles in circumference, had to be circled six times. There were many accidents, but none resulted fatally. Americans will be pleased to learn that Mr. W. K. Vanderbilt, Jr., in a Mors car, finished third. M. Gabriel finished second.

VARIED MODERN USES OF THE AUTOMOBILE.

Apart from its employment as a vehicle of pleasure, the automobile is rapidly entering the sphere of usefulness in the most varied classes of work. The advantages of these machines are being increasingly appreciated and it is only a matter of time when the public will largely discard the horse for labor purposes and adopt the motor vehicle in its place. A most striking example of this competition with the horse will be seen in the accompanying illustration, which shows an automobile drawing a field cultivator. The automobile as shown is provided with wheels especially adapted for traveling over a rough field. The front tires are very broad so as to prevent the wheels from sinking into the soft earth; the rear or driving wheels have tread projections, which insure a good hold and prevent them from slipping. This automobile takes the place of a traction engine, and can be attached to any farming machine desired. Aside from its agricultural uses the vehicle may be jacked up and its wheels replaced by rubber-tired wheels, when it will be found a useful and comfortable conveyance for all purposes. In contrast with this peaceful use to which the automobile is put it will be interesting to note the motor built for war service in South Africa. These machines, here illustrated, were recently awarded first prize in a competition instituted by the British War Office. The Thornycroft Standard, which is essentially a motor truck, is capable of carrying three tons and drawing, further, two tons on a trailing vehicle. It is fitted with a patent central-fire water-tube boiler especially arranged for cleaning the internal surfaces—a most important feature, when, as is frequently the case, hard water only can be obtained. This motor, however, differs from the ordinary type only in the wheels, which are built of solid steel and are somewhat larger in diameter with wider tires. The second vehicle is of an experimental type, especially adapted for use on rough roads and uneven ground, the steering axle being capable of unusually great angle of tilt, while the driving and steering wheels are of a large diameter. The boiler and engine are situated directly over the driving axle, the carrying platform being provided at the fore part of the vehicle. This arrangement gives the wagon great power to get out of holes in soft ground, etc., and enables it to exert its full power as a tractor when it is not itself laden. The boiler and engine are of the same pattern as the Standard motor. It is supplied with a winding drum, and a hundred yards of steel wire. A spring draw-gear is also provided, fitted with the standard military draw hook. The boiler is arranged so that the fire bars can be easily replaced by the liquid fuel burners, which are either of the spraying or vaporizing type, according to the nature of the oil which may be available. A condenser is provided, but it is so arranged that it can be short-circuited or removed without interfering with other parts of the machinery.

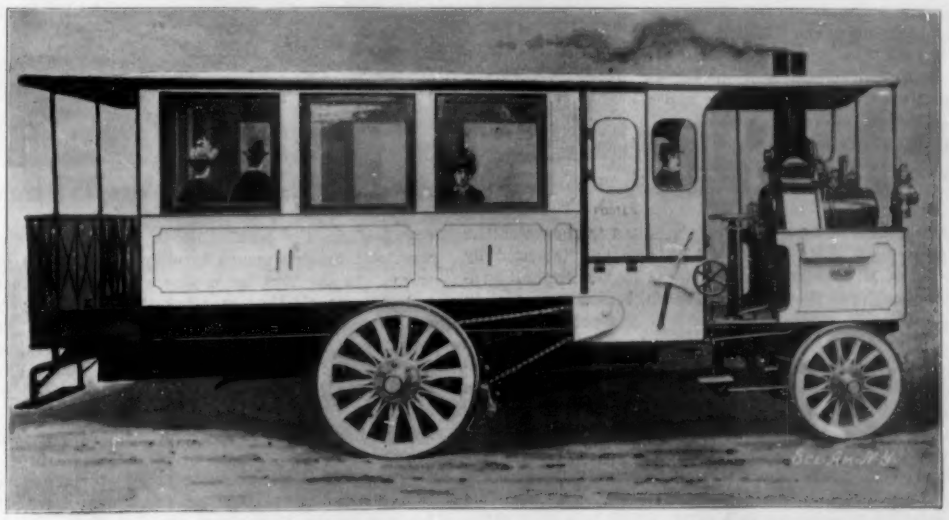


THE AUTOMOBILE AS APPLIED TO RAILROADING.



THE AUTOMOBILE AS USED FOR FIELD CULTIVATION.

Steam vehicles are also being used for passenger service in large cities. We illustrate a steam propelled omnibus of the Turgan-Foy type which is now in use in France. The boiler is placed in front, and the engines, which are horizontal, rest upon the truck-frame under the conductor's bench. Two compound engines are used, and each drives one of the rear wheels directly by chain gearing and the differential is suppressed, giving a decided advantage. The boiler has about 12 square yards of heating surface, with a feed-water heater in the stack and a special superheater in the fire-box, giving a great vaporization and a considerable economy of water. The boiler and its accessories and valves is light, weighing only 1400 pounds. The engines have cylinder diameter of 3.6 and 7 inches, with 6.2-inch stroke, and 600 revolutions per minute. Each will give 20 horse power. A good test of a Turgan-Foy hauling wagon was made at the late military maneuvers in the eastern part of France, where it



TURGAN-FOY STEAM CARRIAGE FOR PASSENGER SERVICE IN CITIES.

did excellent service during 21 days with scarcely a stop. The military commission, directed by Commandant Ferrus, had an interesting series of trials made, and it was shown that the tractor, carrying itself a load of 2 tons, could easily draw 5 artillery wagons forming a train 90 feet long, at the rate of 6 miles an hour. These wagons weighed 4 tons in all, which with the 2 tons carried, gave a total of 6 tons. During the trials it was found easy to start the tractor on grades of 7½ per cent.

The automobile for railroad inspection represents another very novel use to which these machines are put. This automobile, which is of De Dion make, will carry two or three persons along a railroad for inspection purposes, or in roads that have but small traffic it will be found useful for postal services. The frame, which is of steel tubes, is exceedingly simple. At each of the two extremities there are two handles for lifting it and putting it on or taking it off the rails. This operation may be performed by one person. The motor, which is of 3½ horse power, is of the same type as that of the Nouse's voiturettes. It is provided with the firm's new carbureter.

The transmission is effected by gearings, with the interposition of a friction clutch fixed upon the driving axle and controlled by a lever placed to the right upon the frame and within easy reach of the hand. After the apparatus has been thrown into gear, the starting is effected by means of pedals. The four wheels, which are of the same size, are 24 inches in diameter. They are of aluminium shod with iron, and are provided with six spokes. Two lever brakes, one of them of great energy, act respectively upon each of the hubs, and can be operated, according to circumstances, by one or two persons. Their power is such that it is possible totally to block the wheels, which then slide a distance that varies with the speed at which the vehicle is running. The driver is seated in the same way as upon an ordinary tricycle. His hands rest upon a stationary handle bar designed to serve simply as a support, since the steering gear is done away with, as is also the differential, which is absolutely useless in view of the wide radii of the curves of the railway tracks.

The front of the apparatus is provided with a very comfortable seat capable of accommodating two persons, or with a large box. The total weight of the apparatus is 660 pounds. It can be furnished with various gearings to permit of varying the speed from 24 to 36 miles an hour. The experiments made upon the Valmondois Line have given very satisfactory results. —We are indebted to our English and French correspondents for some of the above information.

THE AUTOMOBILE AS APPLIED TO ROAD TRANSPORTATION.

A New Artificial Fuel.

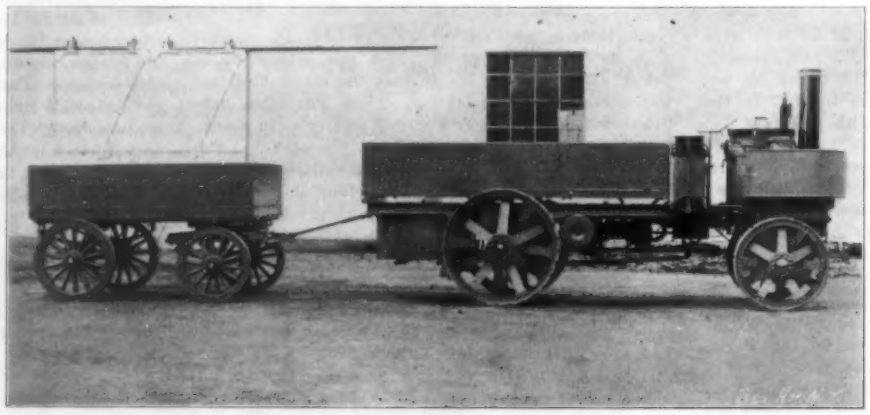
It is gradually dawning upon engineers the world over that the world's coal supply is not likely to last forever, and that the time is not very far distant when artificial fuel must be resorted to. At the present time the need of an efficient artificial fuel has been brought home to us, not because of any fear of the world's supply of coal giving out, but because of the prohibitive prices of anthracite, due to the strike of the coal miners. Inventors innumerable have drawn upon their chemical knowledge in the endeavor to produce a fuel which could compete with coal in efficiency, if not in price. Not so many years ago a prize was offered for a method of solidifying petroleum, or reducing petroleum to such form that it could be carried about readily and used for fuel in fire-boxes. The research thus stimulated resulted in the patenting of several fuels, among which was one invented by Mr. G. M. Randall and introduced by the Randall Synthetical Coal Company, of Boston, Mass. The fuel in question is a combination of peat and petroleum.

The peat is raised from the bog by a clam-shell digger or dredger. It is then conveyed to a disintegrator which separates all coarse material such as roots. From this disintegrator it is conveyed to a press where it is reduced from 80 per cent of water to 40 per cent. After leaving the press it passes through another disintegrator. Lime is then added, which tends further to dry the peat. The resulting mixture is conveyed to a drier, which is a steel cylinder, varying in length according to the capacity required. Petroleum in which bituminous pitch is dissolved is then added in a pug-mill or mixing-mill. After the thorough mixture to which the oil, lime and peat are subjected in this mill, the final briquetting process is all that is necessary to produce the finished product.

The addition of lime results in almost a total combustion of smoke. During the burning of the fuel acetylene gas is formed. The intensity of the flame is such that it insures almost complete combustion of gases, which, under ordinary circumstances, escape in the form of thick black smoke.

The calorific value of the synthetical coal made by this process is represented by 1300 degrees British thermal units. The very best anthracite coal has a value of only 14,000 degrees thermal units, while bituminous coal has a calorific value of 12,500 degrees British thermal units. It will therefore be seen that this particular synthetical coal in efficiency compares favorably with the best fuels at present in existence. In cost the comparison is equally favorable.

Messrs. Thornycroft, the well-known shipbuilders of Chiswick, London, have been carrying out elaborate experiments with a new oil engine, the invention of a Swiss engineer named Berthan, the patents of which they have purchased outright. The motor is specially adapted for small craft. In the ordinary oil engine the machinery has to be set in motion by outside means, generally by the application of manual power. In the Berthan engine reservoirs are placed beneath the seats of the launch, and while the engine is at work a proportion of the gas or vapor generated passes into them, where it is stored ready to start the engine the next time the boat is required. Another notable feature is the reversing gear. At present the system of reversing, where oil motors are used, is not to reverse the engine, but to shift the power from a cogwheel on the crankshaft to one beveled another way, and by this means to alter the direction of the screw. In the Berthan engine a simple movement of a handle is all that is necessary, as this operation causes the propelling vapor to enter another set of valves, and in ten seconds the engine is working full speed in the opposite direction. The new oil motor occupies half the space of the steam engine. Power can be developed in ten minutes, as compared with half an hour which is required in the case of steam.



SPECIAL THORNYCROFT MOTOR BUILT FOR WAR SERVICE IN SOUTH AFRICA.

Congress has appropriated $15,000 for the purchase of additional buffalo for the Yellowstone Park. There are now in the Park about twenty buffalo. Originally there were twenty-two, but two escaped.

The New Ship Canal at Oakland Bay, California.

BY J. M. BALTIMORE.

For a great many years Congress has been making appropriations for the ship channel along Oakland bay, in California. This bay is a long, narrow arm extending eastward for some miles from the main San Francisco harbor. In a maritime and commercial sense the bay is of great importance. A large number of both steam and sailing craft lie at anchor in its waters, and extensive shipbuilding is also carried on along its shores. To keep the channel open for the passage of vessels has been and is of the greatest importance. Dredging has been carried on almost constantly along the channel, and especially at the head of the bay. Here inflowing tides ceaselessly deposit mud which the ebbing waters fail to sweep away. Filth, garbage and sewage of every description accumulate, and the water having no outlet is rendered foul and pestilential. Also many tons of small fish are annually cast up along the tide flats, where they perish and decay.

For the purpose of obviating these annoying conditions, it was recently decided to build a canal from the head of Oakland bay to the lower end of San Leandro bay. This work is now in progress under the supervision of the United States Engineer of the District of California, and is one of the most extensive harbor improvements yet made on the Pacific coast. The canal will afford an outlet for Oakland bay, through which the tides can sweep. As both Oakland and San Leandro bays open out into the main San Francisco harbor, a complete circuit will thus be established, and powerful tide-currents will thoroughly flush out all the wide expanse of bay which has heretofore had no suitable outlet. The following dimensions will help us to form a clearer idea of the magnitude of the work. The canal will be over two miles in length and 400 feet wide at the top. Each bank will slope inwardly and downwardly, thus leaving the bottom 300 feet wide. The average depth of the cut will be about 25 feet, and the work will involve the removal of 1,400,000 cubic yards of earth and stone.

The contract was awarded by the government to the Atlantic Gulf and Pacific Company. Eighteen months were allowed in which to complete the task, but, at the present rate at which the work is progressing, it is confidently expected that the canal will be completed within fifteen months. Operations were commenced early last September and have been pushed forward night and day ever since. A large force of men are employed, supplemented by powerful steam shovels and a large dredge. About 100,000 cubic yards are removed each month. The excavated earth and stone are hauled away by trains and dumped on marshy tide flats, and on this made ground very extensive railroad shops are soon to be built. After the steam shovels have completed the work of excavation, the canal will be opened and the water allowed to flow in, when some general dredging will be done to deepen the canal a little and to level off the bottom. At extreme low tide the canal will be 8 feet deep; at high tide, 16 feet. This latter depth will admit of the passage of all ordinary-sized steam and sailing vessels. The total cost of the improvement to the government will be about $600,000. It is hoped that the new canal will be thrown open for the free passage of all vessels by the first of next year.

A shipping curiosity has been broken up at Teneriffe, Canary Islands, in the Italian ship "Anita," of Genoa, which was the oldest vessel in the world. The "Anita" resembled Christopher Columbus' ship, the "Santa Maria," and was built in Genoa in 1548. She completed her last voyage at the end of March last, when she ran from Naples to Teneriffe. The "Anita" was of tremendously stout build, and had weathered countless storms and tornadoes in all parts of the world. She was also the slowest ship afloat, taking 205 days on one voyage from Baltimore, Md., to Rio de Janeiro.

Estimated Number of Draft Animals.

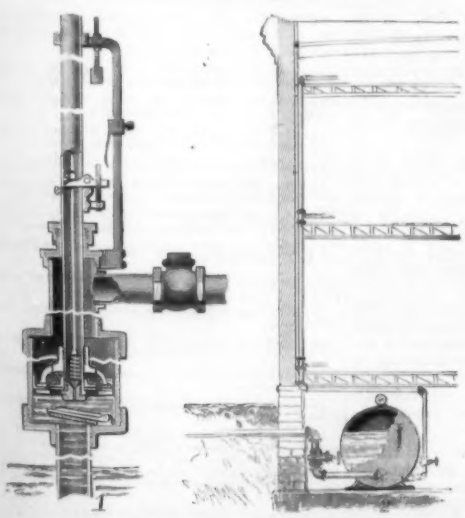
A French authority estimates the number of horses in the world at 74,600,000, and the number of mules and asses at 12,100,000. Despite the inroads of the automobile, there is an unusual demand for draft animals and the prices are high.

A PNEUMATIC WATER SUPPLY SYSTEM.

The problem of water supply is often very serious in buildings which are isolated and have not the facilities for connecting with a general water-distributing system such as is provided for a town or city. Those who are thus situated will be interested to examine the recent invention of Mr. Edward D. Deeter, of Milford, Ind. As shown in our illustration, the invention provides a peculiarly constructed pump, adapted for elevating water from a well, and forcing it into a sealed tank against the air confined therein, so that the pressure of the air will force the water from the tank into a system of water pipes for the supply of one or more buildings. The construction of the pump is such that it will pump air with the water into the receiving tank, thus maintaining a suitable pressure for the service pipes. The construction further permits adjustment of the mechanism for the exact graduation of the amount of air pumped, or an arrest of the air-pumping operation, as may be found necessary. Fig. 1 shows the pumping section, while Fig. 2 shows the relative position of the tank in the building to be supplied. The pump is situated at the top of the lift pipe, from which water is forced through a pipe at right angles thereto, and is conducted into the tank. A clack-valve covers the top of the lift pipe and prevents regurgitation of the water lifted into the cylinder. A hollow plunger-rod extends into the cylinder and is provided at its lower end with a cup-shaped packing-ring, which engages the inner side-wall of the cylinder, and a disk valve which, on upward motion of the plunger, is adapted to close the openings in the base-plate of the plunger-head. The lower end of the hollow plunger-rod is closed by a plug which serves to hold the base-plate in position. The central passage extending through this block is closed by a valve under spring tension. The stem of this valve extends upward and is engaged near the top by a tappet-lever hinged to and passing through the wall of the hollow plunger-rod. An upright post secured to the upper end of the cylinder is provided with an opening at its upper end which affords a bearing for the plunger-rod.

The operation of the main plunger is similar to that of the ordinary pump. On the upward stroke water is drawn past the clack-valve into the main cylinder, and on the downward stroke it is forced past the disk-valve into that portion of the cylinder above the plunger head. On the next succeeding stroke the water is forced into the receiving tank. An ordinary check-valve prevents a return flow of the water. As previously stated the pump is designed to supply air pressure to the tank so that the water may be forced to the upper story of a high building. The air is fed into the pump in the following manner: When the plunger-rod is traveling upward, at a predetermined point the outer end of the tappet-lever mentioned above encounters a spring-limb secured to the guide-post, and is thereby thrown down, its inner end lifting the valve from its seat in the plunger-rod plug. The lever is secured in this position by a pair of spring clamping-arms situated directly below, and is thus held until released by a V-shaped pressure-block at the top of the guide-post, which spreads the spring-arms apart. Air is thus admitted to the cylinder at each stroke, in quantities which can be regulated by the position of the spring-limb on the guide-rod, and from the cylinder the air is pumped with the water into the receiving tank. To stop the pumping of air it is necessary merely to raise the spring-limb to its highest position, where it cannot engage the tappet-lever.

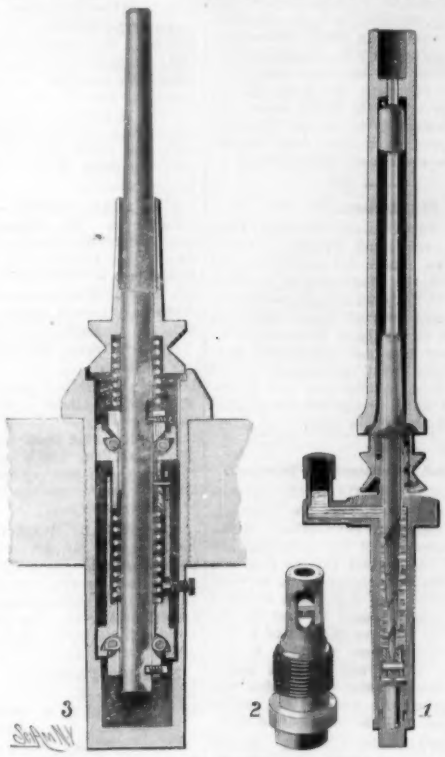
Though the pump, as stated above, is designed for use in furnishing a water supply for buildings not connected with the general water-supply system, it will readily be seen that the invention would be useful in connection with a general water supply for the elevation of the water to a greater height than could be otherwise reached. The pump will also be found useful for the transmission of power, for pneumatically-operated guns, pneumatic or hydraulic drills, and, in fact, for almost any operations which employ pneumatic or hydraulic pressure.



A PNEUMATIC WATER SUPPLY SYSTEM.

IMPROVEMENTS IN SPINNING SPINDLES.

Some recent improvements in spinning spindles have been made by Mr. William Gihon, of Chicopee, Mass. One improved construction is such that the spindle carrying the bobbin or spool is free to turn upon a support and is held from slipping from its proper position while in action, and yet is capable of being quickly and conveniently disengaged from its support when desired, without the manipulation or removal of fastening devices. The bearings and lower portion of



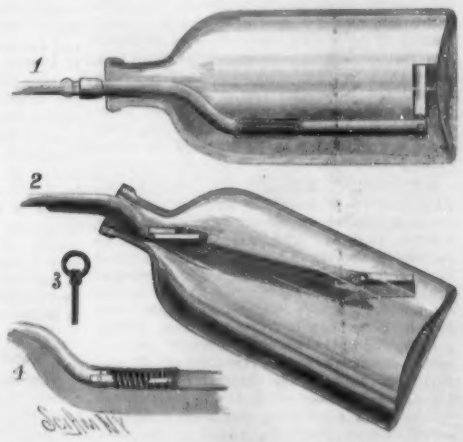
IMPROVEMENTS IN SPINNING SPINDLES.

the spindle are designed to turn in a lubricating bath, and a special form of support forms the lower bearing, which support may be quickly shifted to present a fresh surface to the spindle point in case of wear. These improvements are all embodied in the construction illustrated in Fig. 1. The main support of the spindle is a hollow tube provided near its upper end with an angular feed pipe through which oil is poured into the interior chamber. The lower end of the main support is closed by a plug screwed therein, the flanged portion of the plug being provided with a washer to prevent leakage of the oil. The shank of a tubular bearing-section fits into the bore of the plug. This tubular bearing-section is provided with openings in oppposite sides through which a pin of semi-circular or polygonal cross-section is loosely passed. The plug and bearing-section are shown assembled in Fig. 2, the bearing-section being broken away to show the pin. The pin forms a support for the end of the spindle and is capable of sidewise adjustment, so that when worn it may be shifted sidewise to present a fresh bearing surface. The upper end of the spindle is provided with an exterior spiral thread, and in the interior is a bushing which fits the spindle loosely and is set in such manner as to prevent turning in the bore of the base. This gives what is termed a "ring-bearing" for the spindle. The spindle is provided at its central portion with an exterior conical enlargement. Immediately below this enlargement is a whirl attached to the spindle. This whirl fits loosely over the top of the main support or base and is held in position by a lug which fits into a groove on the base immediately below the spiral thread. Whenever it is desired to remove the spindle, it needs simply to be drawn upward and turned, whereupon the lug will travel up the spiral thread. In order to prevent the oil from feeding upward, a spiral groove is formed on the lower end of the spindle, which leads the oil down to the lower bearing. At the upper end of the spindle is a sleeve loosely mounted which prevents the spool or bobbin from wobbling. In order to further assure a smooth traveling, the upper end of the spindle is passed through an opening made in the inner partition at the upper end of the spool.

Another construction is shown in Fig. 3. Here it will be seen that the spindle is provided with self-adjusting ball-bearings. The body of the spindle consists of a casing closed at the bottom and open at the top. An exterior collar at the top of the casing forms a bearing adapted to rest upon the support to which the casing is threaded. An annular depression is found in this collar to give vertical and guided movement to the whirl on the spindle. A sleeve portion extends upward from this whirl and is provided with longitudinal slots, so as to securely hold any spool carried on the spring portion thus formed. The spindle passes through the whirl and extends in the casing to a point near the bottom. A spiral spring encircles the spindle, pressing between the whirl and the upper cone-bearing, which latter is adjustably secured to the spindle by a set screw. The spring serves as a cushion for the cone. In connection with the cone a ball-race is provided, having suitable pockets for the balls, which are held in place by an inner sleeve. A second cone is fastened face upward to the lower end of the spindle. This also has longitudinal adjustment, but less movement than the upper cone. The ball-race for this bearing is provided with an upwardly extending sleeve which telescopes with a sleeve on the upper ball-race. The sleeves are permitted longitudinal motion, which is limited by a slot in the lower sleeve through which a pin on the upper sleeve passes. A coil-spring between these ball-races serves as a cushion for both bearings. A set screw passes through the main casing and fits into a slot of the lower ball-race sleeve to hold the parts in position. The object of providing the spring cushions is to permit raising of the spindle and whirl a required distance, should the bobbin or spool cling to the whirl, without detriment to the various parts of the device, and without permitting the parts to leave the casing. The casing, it will be observed, forms a well in which oil may be placed; thus the spindle is made self-lubricating. It is clearly evident that this construction will permit easy running and prevent breaking of the yarn. Further, the spool may be removed without disconnecting any parts of the device or interfering with any of its mechanism.

BOTTLE-WASHING BRUSH.

A frequent objection to the bottle-washing brushes of the class having a curved, tubular body is that it is impossible to insert the brush into a bottle having a small opening. The inventor of the brush here illustrated has so constructed the device that it may be easily inserted into the bottle, no matter how narrow the mouth may be. The body portion of the brush consists of two tubular sections, one being curved so that the rubber brush secured thereto will engage and conform to the shape of the inner surface of the bottle. The tubes are split along their under surfaces to receive the edge of the brush material between the two ribs formed thereon, as shown in cross section in Fig. 3. A ferrule is fastened to each end of the tube sections by screws passing thereto, and these screws form supports to which the ends of a helical spring are secured, whereby the two sections are flexibly connected with each other. To hold the sections in alignment two straps are employed, which are mounted at one end to swing on the screws which hold one of the ferrules to its respective tube section, and have slots at the opposite ends through which the screws of the other ferrule pass. To prevent a lateral movement of one of the sections relative to the other, one of the ferrules is provided with a projection designed to engage a notch in the other ferrule. The back portion of the brush is provided with perforations through which water may pass to the interior of the bottle, and at the extreme end of the brush is a swinging section which is adapted for washing the bottom of the bottle. In inserting the brush into the bottle, the two sections will assume substantially the positions indicated in Fig. 2, and when fully inserted, the spring will cause the sections to assume their normal position, as indicated in Fig. 1. The outer end of the tube is designed to be connected with a water-supply in a bottle-washing machine, and the bottle is to be rotated relatively to the brush in the usual manner. A patent for this invention has recently been granted to Mr. Robert Hoerning, Brooklyn, N. Y.



BOTTLE-WASHING DEVICE.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

WIND-STACKER.—W. H. McWILLIAMS, Watonga, Okla. Ter. This invention provides a wind-stacking attachment to threshing machines in which a suction fan is situated at the upper portion of the rear part of the body at a point above the conveyer belt adapted to carry up straw. The location of the fan is such that the straw will be stacked while passing through the casing in which the fan revolves, to a stacking tube, and the grain which is heavier than the straw will drop from the conveyer to a conductor and be directed to the riddles.

CORN-HARVESTER.—H. R. and A. W. SPAHT, of Pattonsburg, and G. SPAHT, of King City, Mo. This machine is arranged to be drawn between two adjacent rows of corn, so as to sever the cornstalks disposed upon both sides. The tendency of the stalks when severed is to pile centrally between two bows and to accumulate in groups resting upon the racks; by pulling the lever the racks are dumped. As a few stalks may be cut during the interval while the racks are being dumped, these stalks are thrown forward upon auxiliary racks. The restoration of the main racks to their normal position causes the dumping of the auxiliary racks, so that the practical effect is that the few stalks accumulated in the auxiliary racks are dumped in the main racks immediately after the main racks have dumped their load upon the ground.

Apparatus for Special Purposes.

FILTER.—W. R. POWELL, Wheeling, W. Va. This filter belongs to that class in which a natural or artificial porous block is employed as a filtering medium. Novel details of construction adapt this device for efficient service and afford a means for periodic cleansing of the filtering medium automatically and thoroughly as occasion may require.

ORE-SAMPLER.—S. E. BRETHERTON, Denver, Colo. In ore samplers now in use it is necessary that the ore be finely crushed, thus consuming much time and labor and making the sample too fine for blast furnace smelting. Mr. Bretherton here provides an apparatus that has not only the advantage of being adapted to take a fair sample of comparatively coarse ore as it comes from the crushers, but, due to its simplicity of construction and the facility with which it may be kept clean, it has many other decided advantages over ore samplers now in use.

TEMPERATURE-EXCHANGING APPARATUS.—JOSEPH DESMAROUX, 4ter Rue des Plantes, Paris, France. This improved temperature changing apparatus permits two fluids or liquids to change their temperature completely, and the apparatus is chiefly designed to bring back to the normal temperature, water which has been brought to an elevated temperature for the purpose of destroying all the germs it may contain. In reducing the temperature of the sterilized water, arrangement is made to impart this heat to water which is to be sterilized.

DRYING-KILN.—A. CAREY, Cairo, Ill. This invention relates to a kiln designed especially for drying veneer and like material. It comprises, broadly speaking, a number of carriers moving horizontally through the kiln and drawing the veneer in at one end and discharging it at the other, the kiln being provided with hot-air-circulating devices.

Electrical Apparatus.

VOLTAGE-REGULATOR.—T. M. PUSEY, Kennett Square, Pa. Mr. Pusey has provided an improved regulator for dynamos and generators, whereby the voltage is automatically regulated and a practically even circuit current is provided for lamps or other purposes. A balance beam on the device is so arranged, under the control of a solenoid, that when the current falls or increases it will operate a motor which throws the switch arm of a rheostat sufficiently to readjust the voltage.

ELECTRIC LAMP.—HENRY WARD BEECHER, Jr., Port Townsend, Wash. The object of this invention is to provide an electric incandescent lamp which will permit of the variation of the amount of light afforded. Heretofore turning-plug switches have been employed which embodied a commutator with a variable amount of resistance, more or less of which was thrown into the circuit. This invention, however, is an improvement in another class in which a lamp with two or more filaments of different sizes and radiating power is so arranged that by a mere turning of the glass globe the current may be directed to either or both filaments.

AUTOMATIC ELECTRICAL SIGNALING APPARATUS FOR RAILWAYS.—J. E. SPAGNOLETTI, Goldhawk Works, Goldhawk road, London, England. This invention provides an electrically operated multiple-switch, adapted to control the passage in the signal-circuits of electrical currents having the tension in use on the railway for traction purposes. The switch is permitted to move from normal position by an electro-magnetically operated switch releasing device, the circuit of said device being under the control of a train-operated circuit-closer contact. By this means the entry of a train on any section has for effect to first cause the signal at the commencement of that section to be put to danger, and then the signal at the commencement of the preceding section to be put to safety.

Engineering Improvements.

ROTARY ENGINE.—F. A. PALLS, New York, N. Y. The engine is provided with a cylinder in which a shaft extends eccentrically. This shaft carries a piston provided in its peripheral face with cut-out portions having segmental walls on which the piston-heads fit. The piston-heads are mounted to swing in and out on the piston as the latter rotates in the cylinder, and at the same time the space between the piston and the rim of the cylinder is closed by the corresponding piston-head having connection with the block sliding on the inner face of the cylinder rim.

DRAFT DEVICE AND SPARK-ARRESTER.—GEORGE B. RAIT, Sheldon, Ia. The invention relates to improvements in draft devices and spark-arresters, particularly for locomotive engines, and provides an improved spark arrester by means of which the draft will be equalised through all of the boiler tubes, and the cinders be thoroughly broken up, arresting the sparks and preventing them from passing out of the smoke stack until extinguished.

Hardware.

ROCK-DRILL CHUCK.—M. MCHALE, Phœnix, and J. TRAINNER, Eholt, Canada. The invention relates to chucks for rock-drills and has for its object the production of a chuck into and from which a drill may be easily and quickly removed and inserted, and which, while it possesses great simplicity of structure, holds the drill in a very firm and satisfactory manner, thus insuring a great saving over chucks commonly used, both in first cost and in the numerous repairs which become necessary when more complicated devices are used.

Machines and Mechanical Devices.

MACHINE FOR FINISHING BARRELS.—G. M. CARTER, Poplarbluff, Mo. The invention relates to a machine for chamfering, crozing and howeling barrels, and for trimming the ends of a barrel preparatory for the insertion of the heads. The machine consists, in combination with a frame, of a carriage mounted thereon, and a ring arranged to turn in the carriage. The ring receives the end of a barrel, while cam-shaped dogs mounted in the ring engage the barrel and hold it firmly therein. Means are provided for turning this ring and presenting the end of the barrel against tools which perform the required work.

EXERCISING-MACHINE.—J. C. KORTH and A. GANZENMULLER, New York, N. Y. This machine belongs to that class of exercisers in which elastic cords are employed in connection with handles and a support. The exerciser is so constructed that it may be used as the ordinary travelers' exerciser and it provides means whereby the exerciser may be used to good effect as a chest expander, or it may be arranged to bring into action many prominent and minor muscles which could not be benefited by machines of the ordinary type.

VALVE MECHANISM FOR COIN-CONTROLLED GAS-VENDING MACHINES.—W. J. STRONG, Brooklyn, N. Y. The invention relates to coin-controlled gas-vending machines, and its object is to provide a new and improved valve mechanism which is simple and durable in construction, automatic in operation and arranged to prevent tampering therewith and consequently unlawful use of gas, unless the proper coin is introduced into the coin mechanism.

PILL-MAKING MACHINE.—J. N. DEWS, Portsmouth, Va. By a novel and simple construction this machine is designed to cut a roll of material into the desired number of sections to provide the number of pills prescribed in any instance. The invention not only facilitates the division of the roll into equal parts, but also enables this result being secured with great accuracy.

CALENDAR-CLOCK.—JOHN I. PEATFIELD, Arlington, Mass. Mr. Peatfield has provided an automatic calendar which is practically perpetual, requiring no manual setting or regulating except in the winding of its motor at intervals of a year or more. It is so arranged that it may be controlled by an ordinary clock mechanism for changing the date and the day indicated every twenty-four hours; it further provides a simple mechanism for making the changes from month to month and the dates from the short months to the first day of the next month.

MAIL-BAG CATCHER.—C. C. MCILYAR, Cambridge, Ohio. The invention relates to means for receiving and delivering mail-bags to and from cars moving on a railroad. The object of the invention is to provide a simple device for this purpose which embodies novel details of construction, rendering the same very convenient and reliable in use, and which is adapted to simultaneously receive and deliver mail-bags or pouches while the mail-car is in motion.

Vehicles and Their Accessories.

AUTOMOBILE.—S. S. CONANT, Edgerton, Ohio. The construction of this automobile is such that the stub axles of the fore wheels are rotatable horizontally around vertical axes, and also slidable vertically thereon, so that the wheels may all be turned simultaneously, the two forward wheels turning in opposite direction to the rear ones, which thereby run in the tracks of the forward ones. The invention also includes a novel arrangement of springs for supporting the body of the vehicle.

COUPLING FOR WAGONS.—W. S. CHAPMAN, Kippen, Idaho. This invention is an improvement in that class of couplings between the reach and the rear hounds of the wagon, which permit adjustment of the hounds and the rear axle on the reach, the same being effected by means of a clamp, in place of the usual coupling effected by means of a pin passing through the reach, whereby the latter is weakened.

Miscellaneous Inventions.

HEATING-STOVE.—C. MATTHEWS, Columbia, Mo. This heating stove is more particularly adapted for burning wood, hay, straw or other like material. A special construction is provided, whereby not only increased heating surface is afforded, due to peculiarly-arranged smoke-flues, but also, owing to the interchangeability of parts, whenever any part is burned out, the same can be removed and replaced by any person.

TROUSERS-FORMER.—L. F. ANDERSON, Quincy, Ill. Mr. Anderson has invented an improved trousers-shaper, which is simple and durable in construction and adapted to be folded into a comparatively small space when not in use. The trouser-former is arranged to shape and smooth either new or bagged and wrinkled trousers.

DEVICE FOR TEACHING ARITHMETIC.—J. J. TERRAZAS, Mexico City, Mexico. This invention provides a simple device by the aid of which operations of adding and subtracting may be readily performed in a mechanical way, thereby lessening the mental labor and chances of errors. The appliance enables the teacher to give the pupils a concrete and readily intelligible representation of the relative value of various numbers.

ARTIFICIAL TOOTH.—T. STEELE, Red Bank, N. J. Mr. Steele has invented an improved artificial tooth arranged to permit convenient and secure attachment of the metallic backing to a front made of porcelain or other suitable material. The construction allows of immediate repair in case part of the tooth is broken or damaged.

NECKTIE-FASTENER.—J. A. CLINTON, Brooklyn, N. Y. In this invention the necktie is arranged to be secured directly upon the collar-button. The collar-button being placed in the shirt and collar, the necktie is raised in position and its fastening devices snapped over the bulb of the collar-button. To remove the necktie it needs merely to be pulled outward.

CARRIER.—J. G. COFMAN, Comptche, Cal. This carrier will be found useful for persons carrying wood from the woodpile to the house, for holding wood in a neat pile in the kitchen or other place, or for binding, carrying or elevating fodder, hay, straw and other light materials. The construction of the carrier is very simple and durable and the article may be cheaply manufactured.

FURNITURE FOR FORMING PAPER-BOX PLANTS.—J. T. CRAW, Jersey City, N. J., and F. SCHLEY, Brooklyn, N. Y. This furniture for forming paper-box blanks may be set up without the use of corner pieces and may be quickly assembled and placed in any desired position, two pieces wherever brought in contact at right angles to each other, forming a well-defined sharp corner. The invention provides a novel means for automatically forcing a blank when made and scored from engagement with the knives or score-blades.

GUN-CLEANER.—G. H. GARRISON, Bucoda, Wash. This gun-cleaner belongs to that class in which the wiper or cleaning-pad may be adjusted to guns of different bores. A simple means is provided for spreading the pad and for securing the pad material to the cleaner-rod. The pad is formed of layers of wire-cloth firmly pressed together so as to withstand wear.

PRISM-GLASS FOR SKYLIGHTS.—G. E. ANDROVETTE, Brooklyn, N. Y. Mr. Androvette has invented a novel construction and improved form of prism panel or plate and supports therefor. These supports and plates are arranged to be quickly and expeditiously connected in such manner as to insure a water-tight construction.

BARREL.—O. P. HALLOCK, Mattituck, N. Y. This barrel is an improved receptable for transporting vegetables and produce of various kinds. The improved barrel is composed of staves connected by flexible wire fastenings and is distinguished from other barrels of the same class by a novel construction and peculiar arrangement of parts.

PARALLEL-RULER.—J. STERNFELD, New York, N. Y. This drawing instrument is easily manipulated and may be readily adjusted to enable the user to draw parallel lines spaced at desired distances. The ruler is particularly adapted for section-lining, and the intervals between the lines may be quickly adjusted to suit the user.

SWINGING GATE.—SUPPLINA HAMILTON, Endicott, Wash. This swinging gate embodies an extremely simple construction which dispenses to a large extent with metallic parts. It may be made, erected, and repaired by any unskilled person, thus placing it within reach of farmers of moderate means. An improved means is provided for releasing the latches previous to starting the gates on their swinging movements. The gate-swinging devices and latch-lifting devices may be simultaneously operated by a single pull of the proper cable wire.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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We design and build special and automatic machinery for all purposes. The Amstuts-Osborn Company, Cleveland, Ohio.

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Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 149 Varick, cor. Spring Streets., N. Y.

Inquiry No. 2967.—For a light 6 to 10 h. p. air-cooled gasoline motor.

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Inquiry No. 2968.—For dealers in very thin sheet steel.

WANTED.—A partner in competing for the bonus offered by New Zealand for a new gold-saving device. P. McEntee, Montgomery, Minn.

Inquiry No. 2969.—For makers of small ice machines suitable for restaurants and saloons.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadrigs Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 2970.—For makers of thin sheet steel.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 2971.—For makers of hot water heaters for dwelling houses.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 2972.—For small steam slide-valve engines 1½ x 2 or 2 x 3 inches.

We wish to dispose of a valuable patent on a method for making washers without waste. Full particulars to manufacturers and others interested, on application. Address Novelty Tufting Machine Co., No. 263 Dearborn Street, Chicago.

Inquiry No. 2973.—For dealers in small engine castings.

WOODWORKING MACHINERY.—The advertiser, who has invented and designed for others a line that has brought large returns, is looking for capital against experience and know how. None but mutually satisfactory arrangements desired or expected. Address Experience, Box 773, New York.

Inquiry No. 2974.—For a spring motor of 1-16 h. p. for running a static machine.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 2975.—For a foundry and machine shop capable of handling an iron plate 36 x 48 x ⅝ in.

Inquiry No. 2976.—For dealers in hollow aluminium ware, such as kitchen utensils, etc.

Inquiry No. 2977.—For knife grinders to grind knives 66 inches long, preferably a cup wheel.

Inquiry No. 2978.—For dealers in lightning rods.

Inquiry No. 2979.—For a one-piece, steam-jacketed mixer, with paddles to be lowered from above.

Inquiry No. 2980.—For manufacturers of rubber novelties to make half-soles of special designs.

Inquiry No. 2981.—For makers of small ice machines and brine coils.

Inquiry No. 2982.—For manufacturers of spring motors.

Inquiry No. 2983.—For a fuel oil burner for a small boiler.

Inquiry No. 2984.—For cedar penholder sticks for use in the manufacture of special penholder.

Inquiry No. 2985.—For makers of collapsible (tin foil) tubes.

Inquiry No. 2986.—For makers of hygroscopic spirals.

Inquiry No. 2987.—Wanted, the address of the makers of the Seitz coal-loading machine, which moves around a yard from pile to pile under its own power, and loads wagons with coal without any human assistance other than that which directs the running of the engine.

Inquiry No. 2988.—For manufacturers of porcelain for enameling cast iron sinks.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

July 29, 1902,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.

Adding-machine, J. L. Levin 706,000
Adjustable brace or support for movable structures, J. G. Rossman 705,707
Air-brake system, W. G. MacLaughlin 705,592
Air-cooling, drying, and purifying apparatus, W. L. Moore 705,947
Air-motor, E. Glowacki 705,834
Air purifier, H. v. Puckler 705,865
Alarm. See Refrigerator pan alarm.
Ammonia separator, V. Johnson 705,845
Annunciator, electric, W. G. Winter 705,805
Ash or garbage receptacle, T. W. Hughes 705,672
Asphalt, cooking drums, scraper for, J. P. Nelson 705,954
Automatic switch, H. A. Poppenhusen 705,786
Automobile, S. T. Davis, Jr. 705,824
Awnings, device for raising or lowering, G. H. Egbers 705,744
Axle and axle box, vehicle, H. H. Porter 705,864
Axle, vehicle, J. A. McLaughlin 705,900
Axletree repair implement, F. Richard 705,868
Barrel hook or handle, G. N. Beeching 705,815
Bearing, H. H. Porter 705,863
Bearing for engraving machines, spindle, C. R. Jay 705,674
Bearing, spindle, W. Kilburn 705,847
Bearing, trust, A. E. Henderson 705,839
Beds or seats, framework for spring, W. A. Murray 705,694
Belt, conveyer, W. J. Selleck 705,876
Bicycle attachment, F. Gooch 705,994
Blast or other furnace, E. F. Coffin 705,922
Boiler furnace, A. M. Rankin 705,909
Boilers, soot cleaner for steam, W. Eichelberger 705,912
Bolster roll, J. E. Long 705,983
Bolt locking device, D. Ferguson 705,571
Book, bank deposit coupon, P. Kuehn 705,851
Book cover, Neuendorffer & Witsch 705,859
Book or parcel carrier or holder, T. H. Shotteuberg 705,878
Bottle washing machine, M. P. Shea 705,877
Brake, G. W. Stevens 705,623
Brake head, adjustable, G. P. Ritter 705,611
Brake shoe adjuster, E. M. Herr 705,927
Broom, H. Neilson 705,902
Brush, bottle washing, Volckening 705,983
Brush, sprinkling scrub, F. Pirrung 705,861
Buckle, E. T. Specht 705,620
Buggy top raiser, M. Brown 705,901
Bushings, machine for truing piston ring, A. R. Davis 705,738
Buttonhole cutter, L. F. Monck 705,945
Button, separable, R. R. Slevkropp 705,793
Calculating machine, C. Hamann 705,838
Calendar, collection, E. O. Peterson 705,607
Cam mechanism, G. B. Petsche 705,701
Can. See Ice can.
Car brake, J. R. Montague 705,946
Car fans and ventilators, pneumatic motor for, C. A. Reyes 705,830
Car fender, J. W. Wehmeyer 705,886
Car fender, C. Giblin 705,918
Car fender or guard, tramway, J. Bauer 705,814
Car fender, street, O. Olsen 705,783
Car lighting, generating apparatus for, A. F. Madden 705,854
Car roof, A. W. Wilcox 705,888
Car vestibules, safety attachment for trolley, S. E. Pressler 705,705
Carbonator, G. A. Fiesche et al. 705,661
Carburetor for explosive engines, G. A. Graves 705,995
Card, educational, J. Gibson 705,579
Cartridge, G. Muller 705,949
Cash register, W. H. Bell 705,552
Cash register, Smith & Susstrong 705,619
Cast off, E. T. Specht 705,622
Casting ingots in continuous long lengths, apparatus for, J. O. E. Trotz 705,721
Cellulose products, manufacture of, Frmery & Urban 705,748
Chain belts, machine for assembling links in making, J. C. Howe 705,842
Cigar machine, H. A. Schneckloth 705,872
Cigarette making machine, individual, F. J. Ludington 705,591
Clasp or fastener, N. Crane 705,823
Clock, electric, J. Butcher 705,558
Coating for brick or stone, moisture proof, W. A. Tucker 705,625
Coke ovens or other kilns tight, making the interior of, H. Cochin 705,681
Coking coal, continuous process of, J. Hemingway 705,926
Collar turning and ironing machine, C. C. Gridley 705,666
Combustion promoting and controlling device, E. Baumgartner 705,635
Concrete or the like, machine for mixing, W. J. Judd 705,676
Conduit clamp, F. O. Wellington 705,984
Conveyer, portable, W. L. McCabe 705,778
Core oven, T. L. Griffith 705,665
Corn husker, L. R. Loomis 705,770
Cornish roll, A. J. Gates 705,749
Corset cover, J. M. Van Arsden 705,725
Corset fastener, F. Bitnell 705,643
Cotton chopper, J. H. Forister 705,746
Crushing and pulverizing mill, J. F. Sanders 705,870
Crutch, adjustable, W. F. Drew 705,741
Current motor, automatic, J. Roch 705,967
Curtain stretcher, W. A. Mayr 705,857
Demijohn covering, J. G. Bahr 705,895
Deodorizing, F. M. Pratt 705,787
Designs, transferring, C. Kraut 705,590
Disintegrator, E. R. Sutcliffe 705,796
Distillation, retort for wood, W. B. Chapman 705,906
Door attachment, grain, C. T. Docter 705,655
Door, flexible, J. S. Blake 705,553
Door-stop, J. C. Winn 705,804
Doweling machine, Edwards & Wanters 705,657
Drawers supporter, H. C. Smith 705,879
Dredge, clam or oyster, W. A. Thompson 705,975
Dredge, sewer, E. Chaquette 705,646
Dredger cutter, hydraulic, R. A. Perry 705,784
Drilling edges of boards, machine for, Edwards & Wanters 705,658
Drilling machine, portable, J. Rourke 705,791
Drum, heating, E. Graham 705,921
Drying apparatus, J. C. Fleming 705,914
Dust collector, J. E. Mitchell 705,944
Dust collector and sweeper, pneumatic, J. T. Hope 705,585
Dyeing, etc., apparatus, D. Mattei 705,856
Earth or rock drill, F. H. Dannhardt 705,910
Electric accumulator plates, separator for, R. Alexander-Katz 705,630
Electric battery, E. R. Gill 705,919
Electric circuit, loaded, Lee & Colpitts 705,936
Electric heater, W. S. Hadaway, Jr. 705,668
Electric signal, A. J. Haycox 705,583
Electricity supply purposes, cable terminal box for, G. Wilkinson 705,802
Engine. See Locomotive engine.
Engine ignition regulator, gas, M. J. Sullivan 705,881
Engines, sparker for explosive, G. A. Graves 705,996
Exhaust apparatus, J. Y. Smith 705,713
Fastening table, H. C. Schneider 705,711
Fastening device, R. W. Grove 705,836
Feed mechanism, H. Marles 705,940
Feed trough, J. W. Barnes 705,896
Fence lock, W. B. MacLean 705,951
Fertilizer distributor, A. McWhorter 705,858
Filter bed, J. C. Wallace 705,726
Filter, water, A. G. Noack 705,696
Finger straightening case, M. Gottschalk 705,920
Fire escape, R. Hammerly 705,580
Fire escape, M. Abrams 705,891
Fire escape and water tower, combined, Schwartz & Bryant 705,710
Fire in oil tanks, etc., apparatus for extinguishing, J. Hazledine 705,925
Fire protecting shutter, automatic, T. Ohno 705,899
Fish trap hook, M. Greer 705,750
Fishing reel, A. B. Hendryx 705,758
Floor mat, flexible metal, G. W. & H. McNeely 705,991
Flue cleaner, T. J. Hart 705,753
Fluids, dispersing, W. J. Morton 705,691
Flush, drip, J. E. Kurtz 705,933
Fly trap, E. Potter 705,959
Formaldehyde, solidifying, R. Groppler 705,667
Forming and pressing machine, W. H. Hayes 705,756
Freezing, Protecting exposed filters or other confined liquid bodies from, L. K. Davis 705,740
Fruit drier, J. E. Kurtz 705,767
Fruit, means applicable for use in transporting, R. R. Blandy 705,637
Furnace, E. O. Rickard 705,965
Furnace stoking mechanism, W. McClave 705,599
Furnaces, valve for heating, W. F. Shick et al. 705,618
Furniture, etc., leg or standard for, W. G. Davis 705,653
Galvanic battery, C. B. Schoenmehl 705,616
Game board, F. E. Morrill 705,776
Game board, M. Schinkel 705,873
Garbage receptacle and means for handling same, J. Thiele 705,718
Garment supporter and waist adjuster, A. L. Matiack 705,690
Garment, union, G. O. Cook 705,652
Gas burner, F. Harper 705,581
Gas-burner, Politsky Agust 705,802
Gas burner, incandescent, A. Murinick 705,950
Gas generating apparatus, carbonic acid, F. A. Fuhkamp 705,570
Gas generator, acetylene, A. & P. L. Davis 705,739
Gas generator, acetylene, S. W. Ray 705,788
Gas generator, acetylene, H. L. Bugg 705,902
Gas producer, J. A. Herrick 705,840
Gas retorts, means for charging, E. Drory 705,656
Gear for traction engines. Drive. D. B. Arnold 705,894
Gearing, compensating, E. Huber 705,588
Gearing, frictional, G. W. Stinebriag 705,714
Genealogical chain record, P. W. Gee 705,833
Glass articles, apparatus for forming, J. A. Arnold 705,813
Glove, boxing, J. Gamble 705,915
Glycerin refining apparatus, Schmidt & Joslin 705,712
Glycosuria antidote and producing same, F. Blum 705,638
Gold and silver from their solutions, apparatus for precipitating, A. James 705,589
Gold, silver, or other ores, cyanid process of working, R. H. Officer et al. 705,698
Golf ball, F. Kempshall 705,766
Grain, etc., apparatus for drying, M. Konig 705,849
Gramophone turn or supporting plates, driving mechanism for rotary, T. Birnham 705,636
Grinding and polishing machine, C. Maldaner 705,593
Gyroscope for obtaining artificial horizons, collimator, Jouttus & Therrode 705,702
Handle. See Tool handle.
Handles to tools, coupling for connecting, W. A. Suttle 705,973
Harrow, rotary wheel, E. Brucker 705,557
Harvester cutter, corn, A. N. Hadley 705,923
Harvester, sugar beet, R. M. Fraser 705,747
Heating system, steam, W. E. Royce 705,969
Hitcher, horse, P. K. Young 705,810
Hitching device, safety, L. H. Abbee 705,629
Hoisting bucket carrier, A. Wirsing 705,806
Hoof pad, yielding, T. Ryan 705,615
Hopple on pastern halter, H. A. Bostwick 705,556
Horizontal positions, means for keeping moving objects in, N. Ach 705,731
Horseshoe, cushioned, P. J. Coates 705,908
Hot air wall register, J. H. Pugh 705,609
Hot blast furnace, E. T. Bradford 705,640
Hydrocarbon burner, M. W. Morgan 705,948
Ice can, F. D. Swaney ..... 705,[illegible]
Ice cream can, R. Bauers 705,551
Igniter, A. H. Humphrey 705,673
Impressions, device for making, D. L. Falardeau 705,831
Ink pad box, J. Quarts, Jr. 705,610
Insulating support for metallic circuits, J. S. Allen 705,811
Intermediate coupling, W. C. Wilson 705,989
Jar opener, W. S. Marsh 705,941
Journal bearing, H. H. Hewitt 705,790
Journal bearing, G. N. Secets 705,871
Key connection, J. T. Schecks 705,792
Knockdown box, J. E. Nethyscl 705,953
Labeling machine, J. J. Gaynor 705,832
Lacing hook, G. W. Chipley 705,562
Lamp, hydrocarbon, W. Hawks 705,582
Lamp, incandescent gas, F. M. Brooks 705,818
Lamp, signal, F. K. Wright 705,808
Lamps by electricity, device for lighting, M. Meyer 705,773
Lampblack, producing, D. J. Ogilvy 706,001
Lantern, A. T. Bishop 705,816
Last, A. G. Fitz 705,574
Letter box, street, F. D. Osborn 705,957
Lever, shunting, W. Taylor 705,974
Linotype machines, trimming mechanism for, F. J. Wich 705,801
Liquid defecating apparatus, J. E. Hatton 705,924
Liquid heating apparatus, J. Fliegel 705,745
Liquid separator, S. C. Hauberg 705,669
Lock, A. R. Fergusson 705,660
Lock, W. A. Markey 705,942
Locomotive engine, compound, C. M. Muchnic 705,692
Loom, Conklin & Singer 705,649
Loom shuttle, H. Bardsley 705,898
Loom shuttle checking mechanism, C. H. Draper 705,911
Loom shuttle checking mechanism, Tubby & Broomhead 705,980
Loom stopping mechanism, automatic, A. D. Emery 705,913
Lubricator, J. M. Pfaudler 705,608
Magnetic core for inductance coils, Lee & Colpitts 705,935
Mail delivery and collection system, F. S. Vogue 705,982
Manure distributer, J. Howell 705,829
Match box, J. B. Frederick 705,578
Metal cleaning and preserving composition, W. C. Oberwalder 705,956
Metal cutting tool, McRorie & Hunter 705,695
Metal piercing machinery for making hollow bodies, B. F. McTear 705,780
Metals and alloys, treating metallic oxids in the production of, F. C. Weber 705,727
Metals from their ores, etc., in electrically heated furnaces, reduction of, R. C. Contardo 705,651
Metallic strap, E. H. Vogel 705,626
Metallic tie and rail fastener, A. Scholer 705,617
Metallic tie and rail joint, J. F. Cleary 705,563
Miner's tool, combination, M. Hardisoeg 705,997
Molds. See Foundation mold.
Mold for hollow concrete articles, W. W. Reeves 705,789
Monkey wrench, C. P. Whittemore 705,799
Motion transmitting device, Stokes & McGlinchey 705,624
Motor, R. L. Barnhart 705,897
Musical instrument, mechanical, J. McTammany 705,952
Needle, tape, M. E. Whittemore 705,800
Nipple, bottle, P. Gauss 705,916
Nozzle, C. R. Harris 705,754
Nut lock, C. L. Dunham 705,743
Nut lock, G. W. Vandevender 705,797
Nut lock, H. Anderson 705,812
Nut lock for rail joints, J. W. Robinson 705,612
Oil burner, J. S. Chenhalls 705,820
Oil fuel generator, W. H. Dye 705,565
Oil, producing cotton-seed, C. O. Phillips 705,785
Ordnance, breech block and chamber for, C. Holmstrom 705,841
Ore bin, G. H. Hulett 705,761
Ores preparatory to smelting, desulfurizing of sulfid, A. D. Carmichael 705,904
Oval cutting machine, W. H. Forker 705,576
Oven swab, G. W. Treichel 705,979
Pail, milk, S. Bruckmann 705,642
Pail, milk, J. H. King 705,678
Paint, W. Leonard-Foote 705,938
Paper board, electrical, H. Frantz 705,850
Panel, lining, ceiling, and floor for buildings, etc., and paving for streets, wooden, W. T. Crosse 705,737
Paper drying machine, Paul & Joslin 705,606
Paper making machines, suction box for, J. B. Lynch 705,684
Parchment free from germs, producing vegetable, A. Mackensen 705,687
Paving, manufacture of bituminous, W. S. Wilkinson 705,728
Paving mixture or composition, asphaltic, Wilkinson & Burchinal 705,803
Pen, fountain, R. C. Paine 705,958
Pencil, lead, L. C. Benjtz 705,990
Pendulum, conical, F. M. Clark 705,947
Phonogram reproducing apparatus, W. F. Messer 705,772
Photographic film and making same, casein, O. Buss 705,643
Pile driver, J. H. Hopkins 705,586
Pile fabric, producing figured, O. Timme 705,977
Pipe hanger, C. W. Smart 705,971
Pipe holder or clutch, D. P. Upson 705,724
Pipe wrench, J. G. Morith 705,596
Pipe wrench, C. L. Dunham 705,742
Planing machine, double working, Lehmann & Maurer 705,852
Planter, cotton, J. A. McCain 705,598
Plate holder, magazine, Brooks & Watson 705,734
Playing ball, E. Kampshall 705,764,
Plow, disk, L. E. Waterman 705,627
Plow, wheeled, L. E. Waterman 705,628
Pneumatic despatch tube inlet, F. R. Talsey 705,884
Polishing machine, M. H. Ballard 705,550
Powder puff, M. L. Gumacr 705,837
Power equalizing, controlling, and storing apparatus, H. Osterud 705,700
Printing press, M. Anthony 705,631
Projecting apparatus, A. & L. Lumiere 705,771
Propeller, adjustable screw, E. E. Punsett 705,866
Pump, H. T. Henson 705,670
Pump mechanism, E. M. Ivens 705,844
Pump, water sealed air, M. Potvliet 705,704
Puzzle, wire, F. Herd 705,750
Radiator, C. W. Rogers 705,614
Rail joint, C. R. Edwards 705,566
Rail joint, W. Floss 705,575
Rail joint, Dixon & Devine 705,827
Rail joint, V. L. Truxall 705,885
Rail support, C. E. Neubauer 705,955
Railway cabs, electric signal for, J. W. Frost 705,602
Railway, electric, C. J. Kintner 705,848
Railway rail joint, J. C. Fair 705,568
Railway rail joint, C. Rhoades 705,903
Railway stock guard, Williams & McCall 705,729
Ratchet mechanism, C. Joss 705,931
Rattle, rythmical, S. S. Burbank 705,819
Reel. See Fishing reel.
Refrigerator pan alarm, Yon & Laprise 705,990
Renegerative furnace, F. H. Treat 705,978
Rein guard, J. T. West 705,986
Retort furnace, W. B. Chapman 705,907
Reversing mechanism, S. Nielsen 705,693
Reversing mechanism, H. R. Reck 705,610
Rheostat, W. H. Chapman 705,561
Rice, etc., machine for cleaning, R. W. Welch 705,985
Rifle, J. H. Carl 705,736
Road breaking machine, I. Wrobel 705,889
Roller attachment, elevating, A. H. Centner 705,905
Rolling flat sheet metal, apparatus for, T. Whitehouse 705,887
Rolling pin, B. Djup 705,654
Rotary engine, J. E. Cary 705,644
Rotary engine, F. G. Grove 705,835
Sad iron, G. Finn 705,573
Sash weight, J. D. Ansley 705,992
Saw clamp, A. J. Jaeger 705,939
Saw filing device, A. J. Beck 705,899
Saw repairing machine, W. Travis 705,720
Scoring machines, adjustable receiving table for, C. W. Hobbs 705,998
Screw driver, G. E. Gay 705,917
Sealing machine, bottle, W. S. Dorman 705,564
Sewing machine feeding mechanism, Batchelor & Hall 705,633
Sewing machine feeding mechanism, C. H. Foster 705,577
Sewing machine feeding mechanism, Onderdonk & Merritt 705,604
Sewing machine feeding mechanism, L. Onderdonk 705,605
Sewing machine guide, Gerlach & Moore 705,665
Sewing machine stitch forming mechanism, H. Fell 705,569
Shade and curtain pole holder, adjustable window, Ashton & Bainter 705,548
Shade roller and fixture, G. C. Mathers 705,594
Shade support, window, F. R. Mease 705,595
Shoe-fastener, M. S. Brown 705,817
Sieve, A. Teichmann 705,717
Sign board, J. M. Nissen 705,781
Sign, electric, T. E. Murray 705,597
Signal device, H. S. Balliet 705,549
Signal mechanism, R. Herman 705,584
Silk fiber, intensifying the luster of, C. Stuart 705,715
Silk lustering machine, C. Stuart 705,716
Sled, C. Miller 705,943
Solder to metal blanks, machine for applying, J. Lee 705,937
Soldering iron, G. Guntz 705,752
Sound record reproducer, T. A. Edison 705,829
Spinning and doubling fibrous substances, machinery for, G. H. Milward 705,774
Spinning apparatus, yarn, J. Booth 705,733
Spraying apparatus, M. J. Caswell 705,645
Square and level, combination, H. H. Richardson 705,867
Staircase, winding, H. Snider 705,794
Stamp, time, N. Collins 705,909
Steam boiler, E. W. McCanna 705,779
Steam generating and water heating boiler, F. Logan 705,682
Steam heater, low-pressure, F. Tudor 705,981
Steering mechanism, Allen & Danforth 705,892
Stereoscope, H. E. Richmond 705,706
Sterilizing water, etc., apparatus for, D. Grove 705,751
Stethoscopic instrument, Knudson & Clark 705,934
Stone cutting for buildings, artificial, Kelly & Sazain 705,846
Stone, artificial, V. Conti et al. 705,650
Stool, foldable, P. R. Anton 705,893
Stopper fastener, J. A. Jones 705,675
Stove, W. Heuermann 705,928
Stove, heating, W. Drengwitz 705,828
Stovepipe holder, J. S. Rhodes 705,697
Street receiver, T. J. O'Brien 705,697
Sugar refining apparatus, J. Robin-Langlois 705,869
Suspenders and trousers connection, R. T. Clarke 705,648
Suspenders, cast-off connection for, E. T. Specht 705,621
Swing, E. Lurch, reissue 12,018
Table, G. H. Bullock 705,903
Tack puller, T. G. Bladen 705,554
Tag holder, W. S. Jacobs 705,762
Tailor's pressing machine, J. Goziech 705,826
Telephony, J. Lyons 705,685, 705,686
Temperature regulator, A. Roesch 705,613
Thill coppling, Spitzli & Ford 705,795
Thread cutting die, adjustable, I. B. Yates 705,809
Threshing or separating machine, G. E. Wilson 705,987
Time switch mechanism, G. Zaepfel 705,991
Tire, wheel, H. Lieberthal 705,748
Tobacco fork, W. L. Moore 705,775
Tobacco pipe, H. M. Willis 705,988
Tool handle, adjustable garden, W. V. Magee 705,689
Tooth mold, artificial, T. Steele 705,972
Toy bubble blower, L. H. Rockwell 705,906
Toy game, R. Astarita 705,632
Toy or advertising device, J. A. Mangold 705,855
Toy, sounding, L. Long 705,939
Trace fastener, W. H. Thompson 705,719
Track sander, pneumatic, E. M. Holley 705,757
Transit instruments, solor attachment for, O. F. Shattuck 705,970
Trolley, W. L. von Hardenberg 705,798
Trolley, T. W. Sutton 705,882
Trolley head and wheel, W. A. E. Davis 705,825
Truck, railway car, H. R. Keithley 705,763
Truck, wardrobe, J. J. Cannan 705,560
Truss, bernial, J. H. & D. L. Chesterman 705,821
Turbine, steam or gas, H. Zoelly 705,890
Type writer or analogous key cap, W. B. Savell 705,709
Type writing machine, T. Cahill 705,559
Type writing machine, C. W. Howell, Jr. 705,587
Types or matrices, mechanism for justifying lines composed of, E. Mullendorff 705,693
Uncoupling device, H. Bruns 705,735
Valve, balanced slide, J. T. Wilson 705,730
Valve, safety, W. C. Field 705,572
Varnishing, G. Tuschel 705,723
Vault cover, Knapp & Steinberg 705,679
Vehicle, L. B. Truslow 705,722
Vehicle wheel spindle, E. E. Root 705,968
Vehicles, differential gear for self-propelling, A. Herschmann 705,671
Vehicles, two speed and differential gear for motor, J. C. Robbins 705,790
Veneer drying machine, M. Rossow 705,708
Vise, drill, and bolt holder, combined, E. L. Kennedy 705,932
Voucher, H. Wise 705,897
Wagon jack, J. D. Mack 705,853
Wagon rack, Harris & Reese 705,755
Wall, retaining, F. A. Bone 705,732
Washing machine, J. B. Rentsel 705,932
Washing machine, G. Thomas 705,976
Waste pipe trap, Lombard & Cole 705,769
Waste trap, J. W. McAuliffe 705,777
Watch, stem winding, W. E. Porter 705,703
Water wheel system, horizontal, A. Giesler 705,993
Water wheel system, turbine, A. Giesler 705,994
Wheel, E. J. Edwards 705,567
Wheel making machine, V. P. Keller 705,677
Wind motor, A. Gran 705,922
Wind wheel, A. J. Bolton 705,639
Windlass, sweep operated hoisting, E. R. Storrs 705,889
Windmill, governor for, C. F. Ohler 705,782
Window, J. Horsfield 705,999
Wire machine tension device, barbed, Macke & Miller 705,688
Wire stretcher, R. P. Boatright 705,555
Wire stretcher, S. Bates 705,634
Wire stretching machine, H. Hyde 705,843
Wood splitting machine, O. E. Ellison 705,659
Wrench, J. O'Brien 705,860
Wrenches, construction of, H. Searle, 705,874, 705,875

DESIGNS.

Autocarette body, W. E. Schneider 35,984
Mantel, W. H. & J. F. Walker 35,985
Spoons, fork, or similar articles, handle for, T. Bender 35,982

TRADE MARKS.

Acid and preparations containing same, carbolic, F. C. Calvert & Co. 38,688
Ales, Bartels Brewing Co. 38,678
Batteries, dry, Nungesser Electric Battery Co. 38,689
Bituminous composition or cement, Warren Brothers Co. 38,693
Books, scrap, Perfect Scrap Book Co. 38,697
Caddy bags, M. Hartley Co. 38,671
Cement, certain named, Clark Cast Steel Cement Co. 38,694
Cigars and cigarettes, Ittie, C. Upmann, 38,674, 38,675
Coffee, java and mocha, Nash-Smith Tea and Coffee Co. 38,679
Coffee, roasted, O. H. Griswold 38,680
Conserving compound, E. Utesecher 38,682
Electric cells, primary, Portable Electric Power and Light Co. 38,695
Games, checker board, Saita Versand von August Wasmuth 38,669
Golf balls, M. Hartley Co. 38,670
Grease, compound for extracting, T. H. Price 38,684
Heating apparatus, certain named, Pierce, Butler & Pierce Mfg. Co. 38,701
Ink for finishing edges of heels of boots and shoes, S. A. White Co. 38,690
Inks, printing, S. Ullman Co. 38,689
Knit underwear and hosiery, Robert Reis & Co. 38,695
Lamps and lanterns, portable electric and oil, 20th Century Mfg. Co. 38,696
Lamps, incandescent electric, Bryan March Co. 38,697, 38,698
Marmalade, Coronation Marmalade Co. 38,681
Ointment, C. Meichel 38,673
Paints, Naamlooze Vennootschap Nederlandsche Verffabriek "Eclatin" 38,691
Paints and roofing paints, L. A. Tenny 38,692
Paper, wrapping, waxed, and toilet, Albany Perforated Wrapping Paper Co. 38,696
Remedy for dandruff and a hair and scalp tonic, S. T. Dustin 38,676
Scales, weighing, H. N. Strait Mfg. Co. 38,702
Soap, F. M. Coulter 38,687
Sirup and molasses, table, Towle Sirup Co. 38,683
Talking machines, disk, W. V. P. Bradley 38,698
Tires for bicycles, carriages, and automobiles, pneumatic Fisk Rubber Co. 38,700
Tonic, nerve, E. N. Baker 38,677
Veterinary remedy, E. M. Krueger 28,672
Washing compounds, certain named, C. C. Gerhart 38,685
Yarns and thread, certain named, Calhoun, Robbins & Co. 38,694

LABELS.

"Alderney Baking Powder, for baking powder, National Label Co. 9,331
"Ammonia Celery," for medicine, Thos. Kelly & Son 9,327
"Cast Steel Cement," for cement, Clark Cast Steel Cement Co. 9,321
"Compliments of the Season," for cigars, American Lithographic Co. 9,334
"Cybeline," for dandruff cure, G. L. Tyler. 9,329
"El Intacto," for cigars, C. Stutz, a Firm. 9,337
"Josephine," for cigars, C. Stutz, a Firm. 9,338
"Kempshall Flyer," for golf balls, Kempshall Mfg. Co. 9,323
"Kempshall League," for golf balls, Kempshall Mfg. Co. 9,324
"La Magnita," for cigars, C. Stutz, a Firm. 9,339
"Las Americas," for cotton cloth, D. A. de Lima & Co. 9,322
"Maize Loaf," for cereal food, Gordan & Richardson 9,332
"Mi Elektra," for cigars, C. Stutz, a Firm. 9,340
"Monarch Record," for sound records, Victor Talking Machine Co. 9,326
"Ottoman," for cigars, Lincoln, Seyms & Co. 9,336
"Primus," for bottled beer, Becker & Wheeler Co. 9,335
"Rex Pork and Beans," for pork and beans, Cudahy Packing Co. 9,333
"Sprayine," for medicine, F. W. Robinson. 9,328
"Story's Foot Relief," for foot powder, Fabrikold Co. 9,330
"Victor Record," for sound records, Victor Talking Machine Co. 9,325

PRINTS.

"A Combination Game," for game apparatus, McLoughlin Brothers 536

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.

NEW BOOKS ETC.

SOCIETY OF ENGINEERS. British vs. American Patent Law Practice and Engineering Invention. Paper by Benjamin H. Thwaite. Read at the Royal United Service Institution, March 3, 1902. London: Published by the Society of Engineers. 1902. Pp. 19.

The SCIENTIFIC AMERICAN, in its column of "Legal Notes," has already called attention to Benjamin H. Thwaite's admirable discussion of

(Continued on page 96)

the comparative merits of British and American patent practice. It is merely necessary to say that he has covered his ground fully, and shows how much England might gain by an Americanization of her patent system.

CRYOSCOPIE. Par F. M. Raoult. C. Naud. 1901. No. 13. Pp. 106. Price 50 cents.

This monograph includes all that the famous Raoult had succeeded in accomplishing in the field of cryoscopy. M. R. Lespieau in a very admirably written preface tells us what this work is and how great is its importance.

FRANCES D'INTERFÉRENCE. Par J. Macé de Lépinay. C. Naud. 1902. No. 14. Pp. 101. Price 50 cents.

Prof. J. Macé de Lépinay has divided his work on interference into three parts. The first part is devoted to the explanation of methods of producing interference phenomena. The second part is devoted to a discussion of interference waves and to determinations of the order of interference as well as comparison of lengths. The third part is devoted to what might be called practical applications of interference phenomena.

LA GÉOMÉTRIE NON EUCLIDIENNE. Par P. Barbarin. C. Naud. 1901. No. 15. Pp. 79. Price 50 cents.

M. Barbarin has prepared a work which should be dear to the heart of every modern mathematician. After a discussion of Euclidian theories, he introduces us to a chapter on distance as a fundamental notion, describing in detail the work of De Tilly and Cauchy. His next chapter is devoted to a discussion of plane and special geometry. In the last chapter of the book he introduces us to the chief objections to non-Euclidian geometry and to the answering of these objections.

THEORY OF STEEL-CONCRETE ARCHES AND OF VAULTED STRUCTURES. By William Cain. Second, revised edition. New York: D. Van Nostrand Company. 1902. 16mo. Price 50 cents.

This is the second edition of an admirable little monograph on steel-concrete arches and vaulted structures. The arch of steel and concrete combined is taken up in detail to illustrate the general treatment. It has been throughout this book the aim of the author to give a clear analysis of principles involved, a knowledge of the fundamental principles of the equilibrium polygon alone being assumed.

L'INCANDESCENZA A GAS. Dott. Luigi Castellani. Milan: Ulrico Hoepli. 1902. Pp. 140.

EL PROBLEMA POLITÍCO. José Cascales y Munoz. Madrid: Librería de Victoriana Suárez. 1902. Pp. xlv, 215.

THE "CONSTRUCTIVE AND RECONSTRUCTIVE FORCES THAT ARE ESSENTIAL TO MAINTAIN AMERICAN INTERNATIONAL COMMERCIAL SUPREMACY" AND THAT "UNIVERSAL COMMERCIAL RECIPROCITY TREATIES AND TARIFF REVISION ARE PREMATURE." By George J. Seabury. New York. 1902. Pp. 16.

The United States Department of Agriculture has sent us a monograph on the field operations of the Division of Soils, which is the second report on the subject. The monograph is accompanied by admirable maps.

FIRST BOOK OF QUALITATIVE CHEMISTRY. For Studies of Water Solution and Mass Action. By Albert B. Prescott, Ph.D., and Eugene C. Sullivan, Ph.D. Eleventh Edition. New York: D. Van Nostrand Company. 1902. 12mo. Pp. 148. Price $1.50.

This little book first made its appearance in 1879 for classes taking a short course in qualitative practice. In its present enlarged form the work is intended to acquaint the beginner with chemical change in the light of the present studies of water solution. The authors have kept steadily before them the purpose of familiarizing the student with the character of the chemical elements which he handles and with the nature of chemical change. The book should prove an excellent laboratory manual.

DIE EISENKONSTRUKTIONEN DER INGENIEUR-HOCHBAUTEN. VI. (Schluss). Lieferung. Fortsetzung und Schluss des IV. Abschnittes. Freitragende Wellblechdächer — Eiserne Fachwerksbauten—Massive Decken Unter Verwendung Von Eisen—Eiserne Treppen — Anhang — Tabellen—Sachverzeichnis. Leipzig: Verlag von Wilhelm Engelmann. New York: G. E. Stechert. 1902. Pp. 385-518. Price $2.50.

This is the last installment of a book which supplies the proverbial long-felt want on framed structures and which is particularly adapted for the use of students at technical high schools. Most of the books which have been used for such purposes are either antiquated or are simply architectural works not written from the engineering standpoint. The installments as they have appeared have been reviewed in this column. Of the many engineering works which have come before us for a long time, we know of none which surpasses the present in thoroughness of treatment and trustworthiness of explanation.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled

(8659) C. S. asks: 1. Please answer the following questions. I do not know whether the name is correct, but I have heard that selenium, a metal, changes its resistance to electricity when light strikes it. Kindly inform me about the price, the resistance it offers per square meter of surface, and whether the supposition that it increases its resistance when light strikes it is correct: also how sensitive it is. A. Selenium is not a metal, but an elementary substance which in its ordinary condition is a brittle solid of a glassy luster and fracture and a brown color. It melts at about 430 deg. Fahr., vaporizes at about 1300 deg., and burns with a blue flame, giving out an odor resembling that of putrid horseradish. Ordinary selenium is a very poor conductor, having an electrical resistance 37,500,000,000 times that of copper. When annealed for several hours at a temperature just below its melting point, with subsequent slow cooling, it forms a crystalline substance with a lower resistance. It is now sensitive to light. Its resistance is reduced, not increased, in proportion to the square root of the illumination; and also the effect is greater with a high electromotive force than with a low one. Narrow strips of annealed selenium are formed between the edges of broad plates of metal, so that the cross section is considerable, and thus the resistance is reduced while the area exposed to light is considerable. This is a "selenium cell." When the light strikes it, its resistance may be reduced as much as one-half. A cell whose resistance in the dark was 300 ohms dropped to 150 ohms in the light. Such a cell is not a generator of electricity, but a measuring instrument for determining the intensity of light. 2. Also in what numbers of your SCIENTIFIC AMERICAN is there any article which treats on similar subjects as Stepianek's pictorial telegraphy? 2. We can send you six numbers of the SCIENTIFIC AMERICAN SUPPLEMENT containing articles upon the transmission of pictures by electricity.

(8660) A. L. V. asks: 1. Will you kindly explain the action of the inductor alternator, of the type *not* having a large cylinder at one end? A. The toothed projections upon the moving portion are called the inductors. The surrounding frame has projections of the same shape and size, which constitute the cores of the armature coils. When these two sets of projections are opposite each other, the magnetic reluctance is at the minimum and the magnetic flux through the armature coils is at the maximum. Similarly, when the inductors are in the intermediate position, the flux is at a minimum. Thus the current is produced without moving wire, or collecting devices, with their attendant risk of chafing and loss of energy by friction. See Sheldon's "Alternating Current Machines," price $2.50, by mail. 2. Why is it that, although the current from an X-Ray induction coil is alternating, the discharge passes through the tube in only one direction? A. The secondary current in an induction coil is not alternating when the discharge points are drawn out so far that the spark passes only when the primary circuit is broken. The current then is a succession of impulses all in the same direction, the current produced by the making of primary current is suppressed, not being able to leap the gap. The X-ray tubes used with direct current in the primary coil are all energized in this manner. Their current is unidirectional and discontinuous, and not alternating. 3. In the 110-volt alternating-current system of incandescent lighting, why is it that, though the circuit is always complete through the primaries of the transformers, more power is required when more lamps are put in use on the secondary circuit? A. In any system of incandescent lighting by multiple arc, or parallel arrangement, when one lamp is on, the resistance is such that only the current required for that lamp can flow; when two lamps are turned on, the resistance is half of what it was before, and twice as much current flows. More power is therefore required of the generator. If no lamps were lighted, the generator would not be called upon for any current, and it would run free, offering no resistance to motion except the friction of its armature shaft. This is true of all dynamos, alternating or direct.